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THE GENUS *GALIUM* L. (RUBIACEAE) IN SOUTHERN AFRICA

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ABSTRACT

A new classification of the genus *Galium* in Southern Africa is proposed, based on morphological investigations, karyology, pollen measurements, and ecological observations. Twenty taxa belonging to fourteen species are recognized: (1) *G. thunbergianum*, with var. *thunbergianum* and var. *hirsutum* in East Rhodesia, Transvaal, Swaziland, Natal, Orange Free State, Lesotho, and Eastern Cape Province; (2) *G. capense*, with ssp. *capense* in the South West Cape and Eastern Cape Province, ssp. *namaquense* (stat. nov.) in the Western Cape Province, and ssp. *garipense* (stat. nov.) with var. *garipense* and var. *wittbergense* (stat. nov.) in Transvaal, Natal, Orange Free State, Lesotho, and Eastern Cape Province; (3) *G. monticolum*, a rare species from the Western Cape Province; (4) *G. bredasdorpense* (sp. nov.) endemic to the limestone formations in the Bredasdorp district; (5) *G. amatymbicum*, a rare species from the Eastern Cape Province; (6) *G. bussei*, with var. *bussei* and var. *glabrum* in Rhodesia; (7) *G. scabrelloides* (sp. nov.) in the South Transvaal, Swaziland, Natal, Orange Free State, Lesotho, and Eastern Cape Province; (8) *G. scabrellum* in East Rhodesia; (9) *G. subvillosum*, with var. *subvillosum* and var. *subglabrum* (var. nov.), (10) *G. mucroniferum*, with var. *mucroniferum* and var. *dregeanum* (stat. nov.), and (11) *G. undulatum* (nom. nov.) in the South West Cape; (12) *G. tomentosum* in the Cape Province and South South West Africa (and Orange Free State); (13) *G. chloroionanthum* in East Rhodesia; (14) *G. spurium* ssp. *africanum*, a rare taxon occurring in Transvaal, Natal, and Cape Province.

New chromosome numbers are reported for *G. scabrelloides* and *G. capense* ssp. *garipense* var. *wittbergense* (n = 11, 2n = 22), and *G. mucroniferum* var. *mucroniferum* and *G. subvillosum* var. *subvillosum* and var. *subglabrum* (n = 22, 2n = 44). Previously published chromosome numbers of *G. thunbergianum* var. *thunbergianum* and var. *hirsutum* and *G. capense* ssp. *garipense* var. *garipense* (n = 11, 2n = 22) and *G. tomentosum* (n = 22, 2n = 44) are confirmed by additional new counts.

UITTREKSEL

DIE GENUS *GALIUM* L. (RUBIACEAE) IN SUIDELIKE AFRIKA

'n Nuwe indeling van die genus *Galium* in Suidelike Afrika word voorgestel; dit word baseer op morfologiese ondersoeke, kariologie, stuifmeel afmetings en ekologiese waarnemings. Twintig taksa behorende tot veertien soorte word erken: (1) *G. thunbergianum*, met var. *thunbergianum* en var. *hirsutum* in Oos-Rhodesië, Transvaal, Swaziland, Natal, Oranje-Vrystaat, Lesotho en Oostelike Kaapprovinsie; (2) *G. capense*, met ssp. *capense* in die Suidwestelike Kaap en Oostelike Kaapprovinsie, ssp. *namaquense* (stat. nov.) in die Westelike Kaapprovinsie, en ssp. *garipense* (stat. nov.) met var. *garipense* en var. *wittbergense* (stat. nov.) in Transvaal, Natal, Oranje-Vrystaat, Lesotho en Oostelike Kaapprovinsie; (3) *G. monticolum*, 'n skaars spesies vanaf die Westelike Kaapprovinsie;

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(4) *G. bredasdorpense* (sp. nov.) endemies aan die kalkbulte in die Bredasdorp-distrik; (5) *G. amatymbicum*, 'n skaars spesies van die Oostelike Kaapprovinsie; (6) *G. bussei*, met var. *bussei* en var. *glabrum* in Rhodesië; (7) *G. scabrelloides* (sp. nov.) in Suid-Transvaal, Swaziland, Natal, Oranje-Vrystaat, Lesotho en Oostelike Kaapprovinsie; (8) *G. scabrellum* in Oos-Rhodesië; (9) *G. subvillosum* met var. *subvillosum* en var. *subglabrum* (var. nov.), (10) *G. mucroniferum*, met var. *mucroniferum* en var. *dregeanum* (stat. nov.) en (11) *G. undulatum* (nom. nov.) in die Suidwestelike Kaap; (12) *G. tomentosum* in die Kaapprovinsie en suid Suidwes-Afrika (en Oranje-Vrystaat); (13) *G. chloroionanthum* in Oos-Rhodesië; (14) *G. spurium* ssp. *africanum*, 'n skaars takson wat voorkom in die Transvaal, Natal en Kaapprovinsie.

Nuwe chromosoomgetalle word gegee vir *G. scabrelloides* en *G. capense* ssp. *garipense* var. *wittbergense* (n = 11, 2n = 22), en *G. mucroniferum* var. *mucroniferum* en *G. subvillosum* var. *subvillosum* en var. *subglabrum* (n = 22, 2n = 44). Voorheen gepubliseerde chromosoomgetalle in *G. thunbergianum* var. *thunbergianum* en var. *hirsutum* en *G. capense* ssp. *garipense* var. *garipense* (n= 11, 2n= 22) en *G. tomentosum* (n= 22, 2n= 44) word bevestig deur aanvullende nuwe tellings.

INTRODUCTION

The Southern African members of the genus *Galium* are badly in need of revision, the last comprehensive treatment of the genus being that of Sonder (1865) who, in *Flora Capensis*, listed 18 taxa belonging to 14 species, 6 of which were newly described by him. Since then only two short articles dealing with South African taxa of the genus have been published (Phillips, 1917: description of a new variety; Salter, 1937: discovery of dioecism in *G. tomentosum*). A few more publications which primarily concern tropical East African species only marginally touch problems encountered in South African taxa: Brenan (1953) describes three new varieties of *G. bussei* and discusses their confusion with *G. stenophyllum*; Ehrendorfer & Verdcourt (1973) discuss the relationships between various tropical species, some of which extend into South Africa; Verdcourt (1975) discusses the identity of *G. spurium* ssp. *africanum* (= *"G. aparine"*) and separates *G. thunbergianum* into two varieties.

The present publication not only covers South Africa (including Transkei), South West Africa, Swaziland and Lesotho, but also Rhodesia,[1] where a number of taxa centred in the tropics reach their southern limit of distribution. In order to demonstrate the often obvious links between a number of tropical and Southern African species this addition was considered necessary and useful.

The present paper offers a revision of the nomenclature and taxonomy of the taxa in question, but also includes detailed information about morphology, karyology, pollen measurements, as well as distribution, habitats and flowering periods of the majority of taxa, although it needs to be stressed that this study must by no means be considered complete, since information available for some of the species still remains rather unsatisfactory.

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[1] No collections seem to exist from Botswana and Moçambique (South of the Zambezi), although particularly in the latter country some taxa are likely to occur in the mountain ranges bordering Rhodesia.

MATERIAL AND METHODS

The present investigations were based on herbarium material borrowed from the herbaria B, BOL, E, GOET, GRA, K, LISC, NBG, NH, NU, P, PRE, S, SAM, SRGH, UPS, W, WIND, and WU (abbreviations after *Index Herbariorum*, Holmgren & Keuken, 1974), and my personal collections made while in Southern Africa between March 1976 and February 1977. Some of the material was cultivated in a garden in Pietermaritzburg/Natal.

Karyological Investigations and Pollen Measurements

Material and methods as described in Puff (1976a).

Sem Investigations

Living or herbarium material was viewed with a Hitachi SSM 2 at an accelerating voltage of 20 kV. Living material usually needed no preparation at all (Figs 6c, 8e, 8d, for example), although sometimes results were only satisfactory if it was first critical point dried and then coated with gold-palladium (Figs 8a, 8b, for example). Herbarium material generally only required coating with gold-palladium. Flowers taken from herbarium sheets were first boiled to restore their original shape, then subjected to critical point drying, and finally gold-palladium coated (Fig. 8c); this method cannot always be used because of unnatural deformations as a result of this treatment.

Distribution Data and Maps

The "Degree Reference System" as outlined by Edwards & Leistner (1971) is adopted. For greater accuracy, quarter-degree references are given whenever possible. In the distribution maps one dot stands for all collections made in a single quarter-degree square, whereby the actual position of any one collection within the square is neglected. Degree references are also used for collections from Rhodesia.

To establish Degree Reference Numbers the index of *Southern African Place Names* (Leistner & Morris, 1976) was consulted. In the listings of collections the spelling of place names has also been adjusted to that given in Leistner & Morris. Place names used by earlier workers which, in the meantime, have changed, are usually given in brackets after their modern equivalent (synonymy after *Zoo-Historical Gazetteer*, Skead, 1973). To trace down exact localities of Ecklon & Zeyher collections, *Standörter-Verzeichnis* (including *Nachtrag*) and *Vergleichungen* (Drège, 1847a, 1847b, 1848) were consulted.

Distribution maps of taxa centred in tropical (East) Africa (Figs 12, 16, 18, 22): The extra-Southern African range of distribution of these taxa was compiled from data given in *Enumeratio Plantarum Aethiopiae Spermatophyta* (Cufodontis,

1965) and *Flora of Tropical East Africa: Rubiaceae I* (Verdcourt, 1976), and from herbarium material I have seen myself.

Altitudes given in feet were always converted to metres.

Descriptions

It should be noted that descriptions of taxa also occurring in tropical Africa were drawn up from Southern African material only.

Stem diameters were measured in the mid-stem region unless stated otherwise. In the measurements of leaf widths the reflexed margins were not taken into account.

KARYOLOGY

Chromosome counts were determined from preparations of root tips, somatic mitoses in young buds (walls of ovaries, filaments), pollen mitoses, and pollen mother cell (PMC) meioses. Since the somatic chromosomes of *Galium* are rather small (and therefore often difficult to count), an attempt was made to determine chromosome numbers from clearly arranged metaphase I and II chromosomes of PMCs whenever possible.

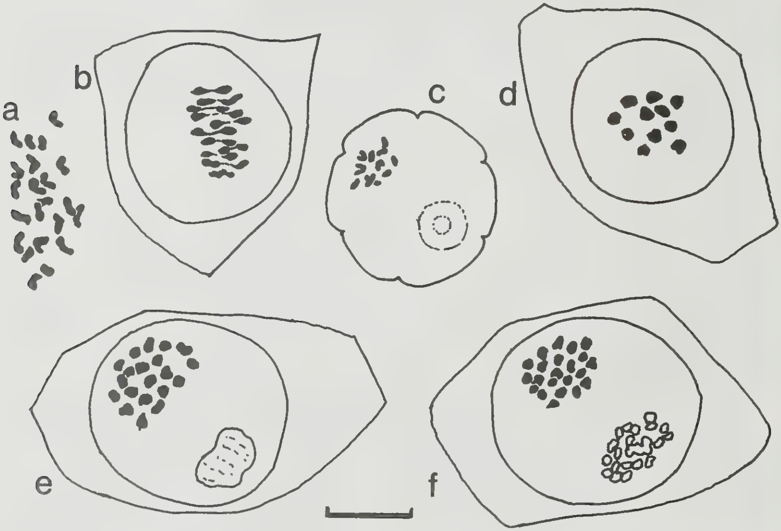

FIG. 1.
Somatic chromosomes of (a) *G. thunbergianum* (x = 11; 2n = 22); pollen mitosis II of (c) *G. capense* ssp. *garipense* (x = n = 11); pollen mother cells of various diploid and tetraploid *Galium* taxa (b, d–f): meta-/anaphase I of (b) *G. thunbergianum* (x = n = 11), metaphase I of (d) *G. scabrelloides* (x = n = 11), metaphase II of (e) *G. spurium* ssp. *africanum* (x = 10; n = 20) and (f) *G. tomentosum* (x = 11; n = 22). The bar represents 10 μm (b–f; for a the bar is 5 μm). Further explanations in the text.

All taxa investigated (with the exception of *G. spurium* ssp. *africanum*) have a chromosome base number of x = 11, the most common base number in the genus. The tetraploid *G. spurium* ssp. *africanum* is characterized by the derived base number of x = 10. Within the x = 11 group diploids (*G. thunbergianum, G. capense* ssp. *garipense, G. scabrelloides*) and tetraploids (*G. subvillosum, G. mucroniferum, G. tomentosum*) were detected. Chromosome determinations for *G. thunbergianum* var. *thunbergianum* and var. *hirsutum, G. capense* ssp. *garipense* var. *garipense*, and *G. tomentosum* (Puff, 1977) are confirmed by additional counts, the chromosome counts for *G. subvillosum* var. *subvillosum* and var. *subglabrum, G. mucroniferum* var. *mucroniferum, G. capense* ssp. *garipense* var. *wittbergense*, and *G. scabrelloides* are new:

Voucher Specimens for Chromosome Counts	n	2n	number of individuals investigated
G. thunbergianum var. *thunbergianum*			
Puff 761221–2/1 (WU)[1]	11		3
Puff 760314–4/2 (WU)	11	22	2
Puff 761125–3/5 (WU)	11		3
Additional counts are published in Puff (1977)			
G. thunbergianum var. *hirsutum*			
Puff 770102–2/1 (NU, WU)	11	22	6
Puff 761209–7/12 (WU)	11		4
Puff 760314–1/1 (WU)		22	2
Puff 760418–1/4 (NU, WU)	11		3
Puff 761219–5/1 (WU) (Fig. 1a, b)	11	22	4
Additional counts are published in Puff (1977)			
G. capense ssp. *garipense* var. *garipense*			
Puff 761220–2/3 (NU, WU)	11		3
Puff 761220–3/1 (WU)	11	22	3
Puff 761226–1/1 (WU)	11		1
Additional counts are published in Puff (1977)			
G. capense ssp. *garipense* var. *wittbergense*			
Puff 761218–1/3b (NU, WU)	11	22	5
Puff 761219–1/2 (NU, WU)	11		3
Puff 761219–2/1c,d (WU)	11	22	4
Puff 761219–6/1 (WU)	11		2
Puff 761220–4/1 (WU)	11		3
Puff 761225–2/2 (WU) (Fig. 1c)	11	22	5
Puff 761227–1/1 (NU, WU)	11		4
G. scabrelloides			
Puff 760314–1/2 (WU)		22	2
–2/2 (WU)		c.22	1
–3/1 (NU, WU)	11	22	5
–4/1 (NU, WU)	11	22	4
–8/4 (WU)		22	1

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[1] Localities of voucher specimens collected by the author can be found in the "Collections" section of the respective taxa.

	n	2n	number of individuals investigated
Puff 760509–1/1 to *–1/5* (all WU)		22	8
Puff 760516–2/5 (WU)		22	2
Puff 761121–3/3 (WU)	11	22	3
Puff 761125–3/6 (WU)	11		2
Puff 761209–7/5 (NU, WU)	11	22	2
Puff 761219–4/1 (NU, WU)	11	22	3
Puff 761220–2/8 (WU)		22	1
–4/1 (NU, WU)	11	22	5
Puff 761221–1/1 (NU, WU)	11		2
–3/1 (NU, WU)	11		3
–4/1 (NU, WU)	11		2
Puff 761225–1/2 (NU, WU)	11		1
Puff 761226–1/2 (WU)	11	22	2
Puff 770101–3/3 (WU) (Fig. 1d)	11		3
G. subvillosum var. *subvillosum*			
Puff 760908–6/2 (NU, WU)	22		4
Puff 760918–2/1 (NU, WU)	22	44	5
G. subvillosum var. *subglabrum*			
Puff 760908–5/11 (NU, WU)	22	44	3
Puff 760920–3/1 (NU, WU)	22		4
Puff 760920–2/4 (NU, WU)	22	44	3
G. mucroniferum var. *mucroniferum*			
Puff 760908–6/3 (WU)	22	44	3
G. tomentosum			
Puff 760910–2/1 (NU, WU) ♀		c.44	2
Puff 760913–1/1 (NU, WU) ♂ (Fig. 1f)	22		3
–1/5 (NU, WU) ♂, ♀	22	44	5
–2/12 (NU, WU) ♂	22		2
Puff 760921–1/1 (NU, WU) ♂	22		4
Puff 760924–2/1 (NU, WU) ♂, ♀	22	44	4
Fagerlind (1937), material of unknown origin (as "*G. asperum* Thunb.")		44	
Additional counts are published in Puff (1977)			
G. spurium ssp. *africanum*	20	40	
Counts of material from the Southern Transvaal and Natal are published in Puff (1977). Fig. 1e is from *Puff 770102–3/1* (NU, WU).			

POLLEN MEASUREMENTS

Pollen investigations were carried out on 305 individuals belonging to 12 taxa; chromosome numbers of 113 of these were known. The pollen quality, although more or less variable, in general is fairly good (most of the grains well developed and three-nucleate; few grains dead, "giants" or "dwarfs"). Only in *G. scabrelloides*, *G. tomentosum* and *G. spurium* ssp. *africanum* were abnormal grains found more frequently. The occurrence of abnormal grains in these taxa, however, seems to vary even within the population level (particularly in *G. tomentosum*).

It is obvious from Figs 2 and 3 that the average pollen diameters of diploids are smaller than these of tetraploids. Within the diploids, the pollen of *G. thunbergianum* is, on the average, smaller than that of the other taxa. Taking into account the fact that within a given ploidy level pollen diameters are ± constant in closely related taxa (cf. Puff, 1976a and literature cited there), it can be concluded that *G. capense* ssp. *capense* and ssp. *namaquense* (no chromosome numbers known) are diploid, like *G. capense* ssp. *garipense*.

In tetraploids, pollen sizes of a particular species seem to have a much larger range than those of diploid species (for example, *G. spurium* ssp. *africanum*: 22,4 μm to 26,5 μm—a range of 4,1 μm). *G. subvillosum*, the closely related *G. mucroniferum*, and the presumably polyploid (tetraploid?) *G. undulatum* have much larger grains than the other tetraploids.

The pollen grains of the tetraploid *G. spurium* ssp. *africanum* (Fig. 3c) are, on the average, larger than those of the North hemispheric *G. spurium* f. *spurium* and f. *vaillantii* (DC.) R. J. Moore (diploid, n = 10; 18–24 μm: Moore, 1975): this once again seems to prove that in related taxa pollen becomes larger with increasing ploidy level. The average pollen diameters of *G. spurium* ssp. *africanum*, however, are smaller than those of the hexaploid and (at least morphologically) closely allied *G. aparine* f. *aparine* and f. *intermedium* (Bonnet) R. J. Moore (n = 33; 25–31 μm: Moore, 1975).

Pollen measurements of plants belonging to the "G. *aparine-spurium* complex" would indicate the occurrence of (at least some) diploids: for a discussion of this problem refer to *G. spurium* ssp. *africanum* "Critical Remarks".

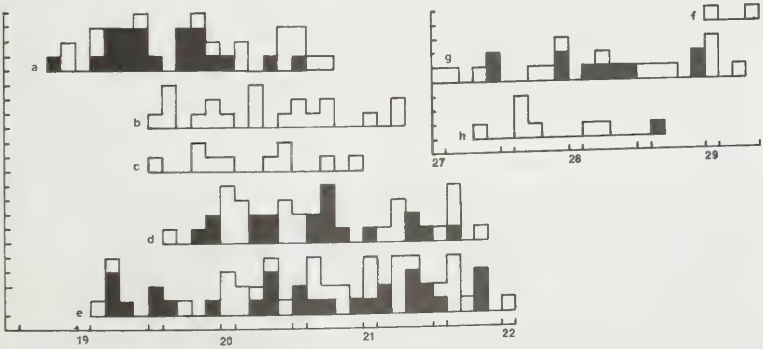

FIG. 2.

Average pollen diameters in μm of *G. thunbergianum* (a); *G. capense* ssp. *capense* (b), ssp. *namaquense* (c), and ssp. *garipense* (d); *G. scabrelloides* (e); *G. undulatum* (f); *G. subvillosum* (g); *G. mucroniferum* (h). Individuals investigated karyologically: black. Vertical scale is numbers of individuals.

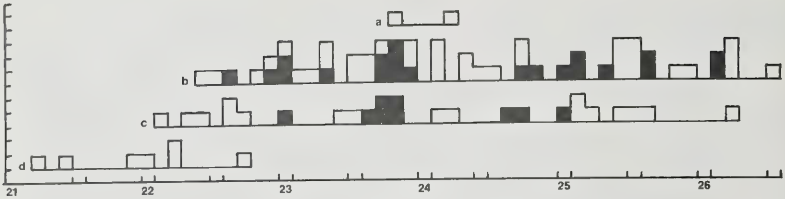

FIG. 3.

Average pollen diameters in µm of *G. chloroionanthum* (a); *G. tomentosum* (b); *G. spurium* ssp. *africanum* (c); "*G. spurium-aparine* complex" (d). Individuals investigated karyologically: black. Vertical scale is numbers of individuals.

It should also be noted that, in addition to the correlation between pollen diameter and ploidy level, there also seems to be a size correlation between pollen mother cells and chromosomes: As can be seen in Fig. 1, pollen mother cells of tetraploids tend to be somewhat larger than those of diploids (compare Fig. 1e, f and b, d), while, on the contrary, chromosome size somewhat decreases with increasing ploidy level (particularly obvious in Figs 1d and f). This phenomenon has already been observed in closely allied species complexes (Puff, 1976b and literature cited there) but, as can be seen here, it also seems to hold true for unrelated or at least not closely related taxa of a genus.

MORPHOLOGY

Habit, stem and branching

With the exception of *G. spurium* ssp. *africanum* (annual) all Southern African taxa are perennials with an often more or less woody base or rootstock/rhizome. In *G. tomentosum* the lower half of the stem is often very woody (up to 20 mm in diam. near the base), but this is never so pronounced in the other species. The length of the stems ranges from 2,5(3) m (*G. tomentosum*) to ca. 100 mm (*G. thunbergianum*, for example), their diameters (in the mid-stem region) from ca. 3(4) mm (*G. tomentosum*) to less than 1 mm (*G. amatymbicum*). Stems are sometimes more or less terete near the base (*G. capense*, for example), but always 4-angled (collenchyma strands) upwards. Stems may be erect or ascending (*G. capense* ssp. *garipense*, for example), caespitose (*G. amatymbicum*) or scrambling or straggling over surrounding vegetation (*G. tomentosum*, for example). They are usually green, but sometimes purplish or purple (anthocyanin. *G. subvillosum*, for example). Internode lengths vary from 80–100 mm (*G. chloroionanthum, G. tomentosum*, for example) to ca. 1–5(6) mm (*G. bredasdorpense*).

The branching is often very variable (sometimes even within a single species) and is probably—as demonstrated for the non-South African *Galium* sect. *Aparinoides* (Puff, 1975)—influenced by environmental factors. Depending on the angle between main axis and lateral branches and the length of the latter, the shape of the plants is broadly pyramidal (long, more or less horizontal lateral branches which decrease in length towards the apex; *G. scabrelloides*, for example), narrowly pyramidal (acute angle between axis and short lateral branches; *G. monticolum*, for example) or (narrowly) cylindrical (short, more or less horizontal lateral branches of approximately equal length; *G. mucroniferum*, for example).

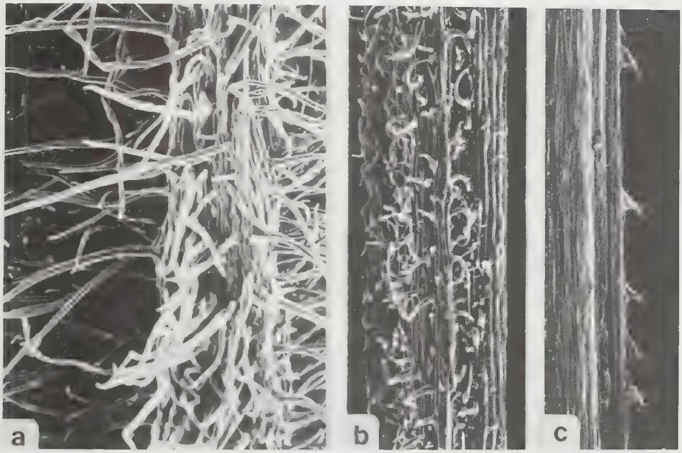

FIG. 4.
Stem portions of *G. tomentosum* (a), *G. capense* ssp. *capense* (b), and *G. spurium* ssp. *africanum* (c) showing characteristic hair covering, a, c: × 20; b: × 30.

The indumentum of the stems can consist of densely set long, more or less spreading whitish hairs (villous; *G. tomentosum*: Fig. 4a), short, spreading white hairs (*G. subvillosum*, for example), short, curled white hairs (*G. capense*: Fig. 4b), more or less massive reversed prickles on the collenchyma strands (*G. spurium* ssp. *africanum*: Fig. 4c, for example), or minute prickles (*G. capense* ssp. *garipense* var. *garipense*, for example). In some taxa the stems are glabrous.

Leaves

Leaves and leaf-like stipules are arranged in whorls of 4 (*G. thunbergianum*), 6 (*G. undulatum*, for example), 6–8 (*G. capense* ssp. *namaquense*, for example), or 6–10 (*G. bussei*, for example). They vary greatly in shape and length: middle cauline leaves can be roundish-ovate, obovate, oblanceolate, ovate-lanceolate, linear-lanceolate or linear, and are ca. 2 mm (*G. bredasdorpense*) up to 35(40) mm (*G. chloroionanthum*) long. Leaf shape and size can be quite variable within a species (cf. *G. tomentosum* and *G. thunbergianum*: Fig. 5a, b), and even a population (cf. Fig. 5a) most probably due to environmental influences [as in the Central European *G. mollugo* group (Zimmermann, 1932) and *Galium* sect. *Aparinoides* (Puff, 1975)]. In the majority of taxa, however, at least the leaf

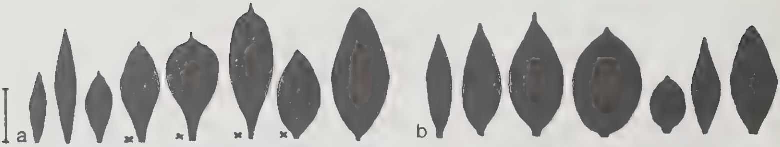

FIG. 5.
Variation in size and shape of middle cauline leaves of *G. tomentosum* (a; "x" denotes leaves taken from one population), and *G. thunbergianum* (b). The bar represents 10 mm.

shape remains more or less constant. The leaves of all taxa are 1-nerved with the exception of those of *G. thunbergianum* (3-nerved). In all South African taxa the apex of the leaf has a more or less distinct hyaline point or mucro (cf. *G. scabrelloides*, Fig. 6c). The leaf margins are often strongly revolute (cf. *G. capense* ssp. *namaquense*: Fig. 6b). Leaf texture ranges from more or less membranaceous (*G. amatymbicum*) to more or less coriaceous (*G. tomentosum*, for example).

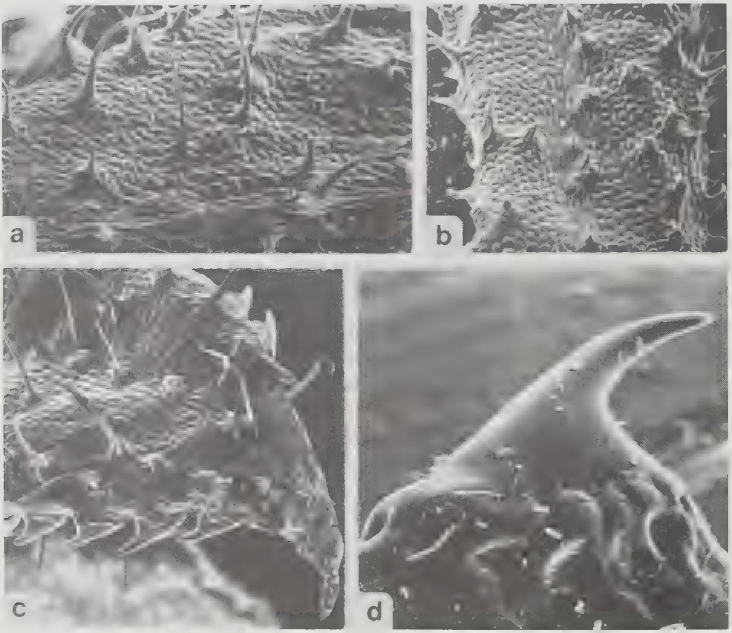

FIG. 6.
Leaf portions of *G. subvillosum* var. *subvillosum* (a), *G. capense* ssp. *namaquense* (b), and *G. scabrelloides* (c, d) showing characteristic hair covering. a–c: × 20; d: × 120.

The following types of indumentum occur: (coarse) reversed prickles on the margin (*G. scabrelloides*: Fig. 6c, *G. tomentosum*: Fig. 6d) and/or white, ± straight spreading hairs on the lamina (*G. subvillosum*: Fig. 6a, *G. scabrelloides*: Fig. 6c, for example), or small, ± forwardly directed prickles on margin and lamina (*G. capense* ssp. *namaquense*: Fig. 6b). In some taxa (*G. thunbergianum* var. *thunbergianum*, for example) the leaves are always glabrous.

Synflorescences

In *Galium* the whole inflorescence system is a monotelic synflorescence sensu Troll (1964): main axes and all other branches (axes) terminate in a flower. To avoid too complex descriptions of the synflorescences all lateral "inflorescences" arising from the main axis are here called paracladia (cf. Fig. 7: pc).

Fig. 7 represents the full spectrum of synflorescence types found in Southern African *Galium* species: Fig. 7a depicts the most common type (in *G. capense, G. scabrelloides, G. tomentosum* and others), in which the paracladia are many-

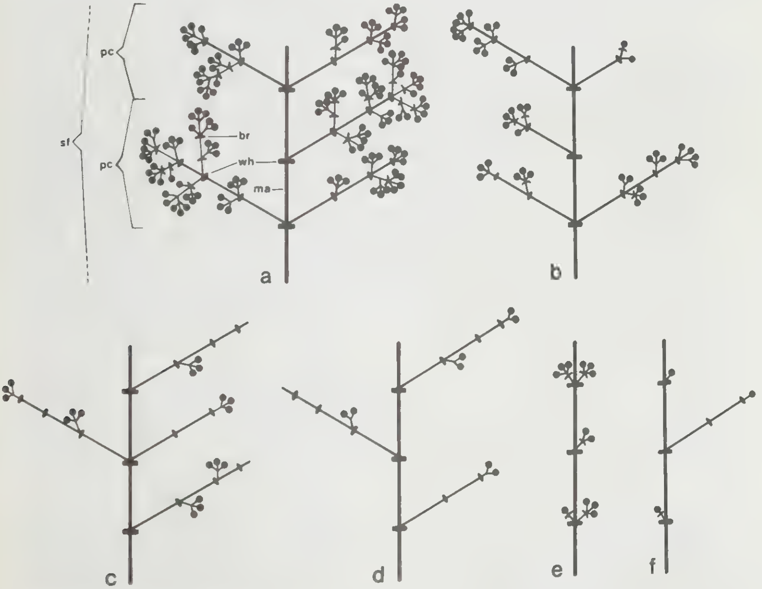

FIG. 7.
Schematic illustration of synflorescence types. Only three nodes of the synflorescence region are shown; it is taken into account that not always two, but often only one paracladium (pc), depending on the species, is produced at one node. br: bract(s) or whorl of bracts; ma: main axis; sf: synflorescence; wh: whorl of foliage leaves. Further explanations in the text.

flowered and the flowers are located on axes of up to the fourth order (in taxonomic literature frequently somewhat incorrectly termed ''axillary panicles''). The type illustrated in Fig. 7b (in *G. thunbergianum, G. undulatum*, for example) has somewhat fewer-flowered paracladia with flowers only on axes of the second and third order. Types transitional between those of Fig. 7a and b may occur (owing to environmentally controlled reduction in flower number?), and are fairly common particularly in *G. capense*. The types illustrated in Fig. 7c and d have paracladia further reduced: they consist of only one of two axillary or terminal groups of three or two flowers (*G. subvillosum* and *G. mucroniferum*, respectively). In the type illustrated in Fig. 7e the paracladia are very short and have a whorl of leaf-like bracts and three to one flowers only (*G. bredasdorpense*). Finally, Fig. 7f shows a type in which the paracladia are reduced to the terminal flower: in *G. spurium* ssp. *africanum* and *G. chloroionanthum* the one-flowered paracladia are always short (in the latter there is always a bract just below the flower), while in *G. amatymbicum* the single flowers may also be located on more or less long paracladia.

It should be noted that the above reduction series in the synflorescence region does not reflect direct phylogenetic relationships of the taxa mentioned as examples. Such reduction series have evolved independently from each other in several other *Galium* species.

The shape of the synflorescence may vary considerably depending on the length of the paracladia and the angle between paracladia and the main axis: cf. ''Habit, Stem and Branching''.

Pedicel length can range from (0,5)1(2) mm (*G. amatymbicum*, for example) to 10(20) mm (*G. mucroniferum*, for example); in ♀ plants of *G. tomentosum* they are much elongated and up to 60(90) mm long. They may be more or less thick and firm (*G. spurium* ssp. *africanum*, for example) or thin, more or less filiform (*G. amatymbicum*), straight and more or less divaricate (most taxa) or more or less arcuate (*G. spurium* ssp. *africanum*, for example) in fruit. In the majority of taxa they are glabrous; in *G. spurium* ssp. *africanum* they are often beset with reversed prickles, in *G. subvillosum* var. *subvillosum*, for example, with more or less long, whitish hairs; in *G. tomentosum* they are villous.

The peduncles are usually about as long as the pedicels and correspondingly hairy.

Flowers

All Southern African taxa with the exception of the dioecious *G. tomentosum* (Fig. 8a, b: ♀, note rudimentary stamina; Fig. 8c: ♂) have hermaphrodite flowers. The 4-merous corolla is always rotate, glabrous (most taxa) or somewhat hairy outside (*G. scabrelloides*, cf. Fig. 8d, or *G. thunbergianum* var. *hirsutum*, for example). The corolla lobes are more or less ovate to triangular, about as long as wide (*G. chloroionanthum*) or (much) longer than wide (all other taxa), acute or acuminate, but never obtuse. Corolla colour ranges from brilliant yellow, yellow, pale and creamy yellow, yellowish-green to greenish-white or whitish (sometimes colour is variable even within a species: *G. thunbergianum*, for example), but none of the Southern African taxa have pure white corollas. In *G. subvillosum*, the

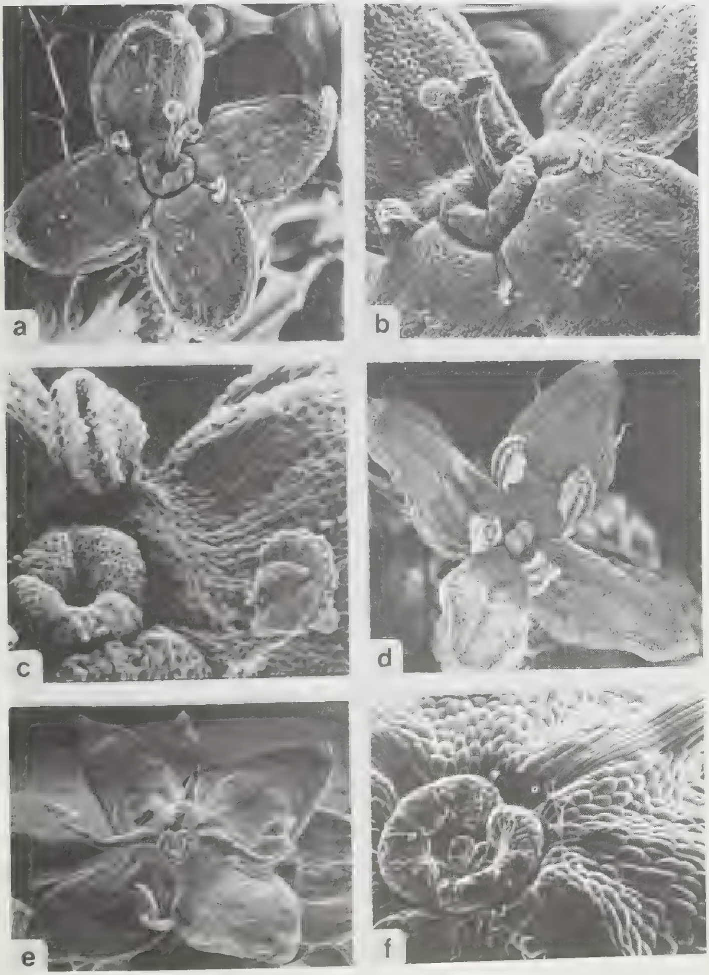

FIG. 8.
Flowers of *G. tomentosum* (a, b: ♀; c: ♂), *G. scabrelloides* (d), and *G. subvillosum* (e, f). a, d, e: × 20; b, f: × 60; c: × 80. Explanations in the text.

corollas may occasionally have a purple tinge (sun-exposed specimens?; corollas normally creamy yellow). The calyx is always completely reduced. The two-lobed disk (superimposed on the 2-carpellate inferior ovary) is usually more or less massive (cf. Fig. 8f). The 4 stamina are nearly as long as the corolla lobes (*G. mucroniferum*, *G. subvillosum*: Fig. 8e) or much shorter (less than half as long as the corolla lobes: *G. scabrelloides*: Fig. 8d; even shorter in *G. tomentosum* ♂: Fig. 8c); the anthers are usually more or less elliptic. The styles are fused to the middle (or at least $^1/_3$), the free ends often arch downward; the stigmas are always capitate.

Fruits

The fruits consist of two mericarps which are globose to subglobose (most Southern African taxa, cf. Figs 9 and 10 a–d) or more or less reniform (*G. tomentosum*: Fig. 10f). They are always dry (never fleshy). Their surface can be glabrous (usually more or less granulate: *G. tomentosum*, Fig. 10e, for example) or covered with white, stiff, hooked hairs which are tuberculate (on a distinct elevation of the skin tissue: cf. Moore, 1975; *G. thunbergianum*, Fig. 9a, b, for example) or non-tuberculate (*G. spurium* ssp. *africanum*, Fig. 9c, d, for example; wrinkles in the skin, however, may occasionally simulate tubercles). In *G. chloroionanthum* (Fig. 9e, f) the hooked hairs are always brown and appear to be flattened at least on herbarium material; no fresh material was available. The mericarp surface can also be covered with (more or less long) straight, white spreading hairs (*G. scabrelloides*, Fig. 10a, b: tuberculate), very short, straight hairs (*G. subvillosum*, Fig. 10c, d), or short, more or less curled hairs (*G. capense* ssp. *garipense*; occasionally in *G. tomentosum*, cf. Fig. 10f). Sometimes only one carpel develops into a fruit. In this case the hairs are much more closely spaced on the aborted carpel than on the fertile one (cf. Figs 10c and 10d): obviously the hairs are initiated at a very early stage of development and become more widely spaced as a result of fruit diameter increase during development.

G. tomentosum has mericarps with three distinct grooves (cf. Fig. 10e), a feature absent from all other Southern African species.

Mericarp size (diameter of a single mericarp) ranges from (0,7)0,8–1(1,2) mm (*G. amatymbicum*) to (2)2,5–3,5 mm (*G. undulatum*, for example).

POLLINATION BIOLOGY

All Southern African taxa with the possible exception of the annual *G. spurium* ssp. *africanum* (autogamous?) appear to be entomogamous. Field observations are fragmentary, but small insects (small flies, not precisely identified) were at least observed on flowers of *G. tomentosum* (♂ and ♀ plants), *G. scabrelloides* and *G. capense* ssp. *garipense*. The flowers of the last two were found to be strongly scented. Flowers of *G. thunbergianum*, *G. capense* ssp. *garipense*, *G. scabrelloides*, *G. subvillosum* and *G. mucroniferum* that were investigated in the field

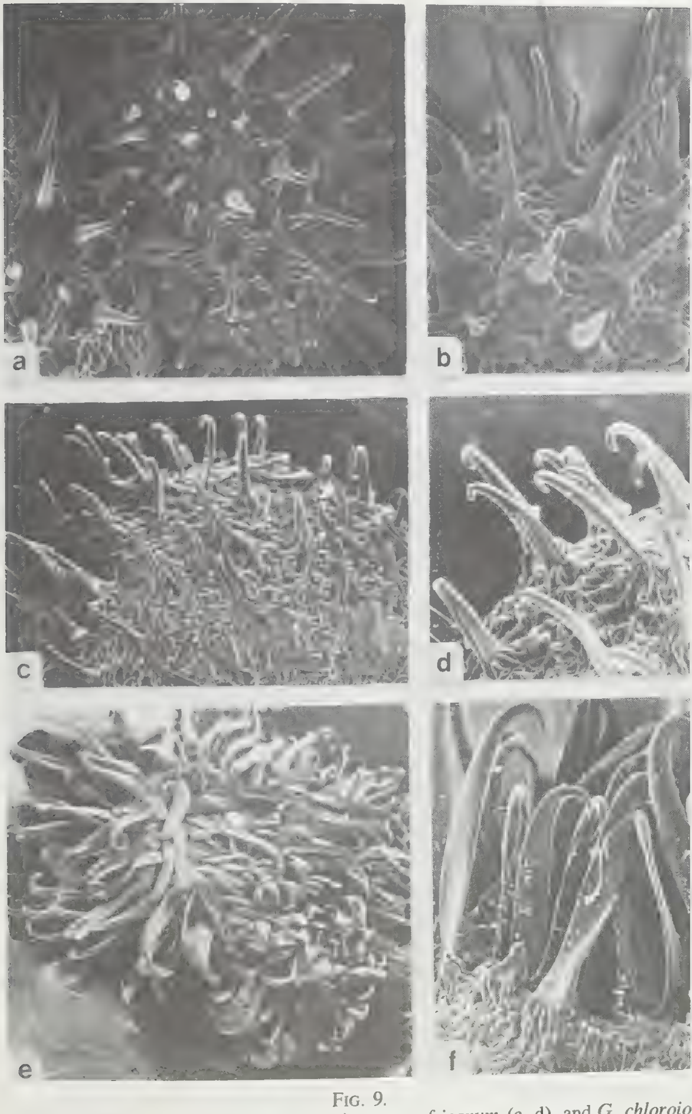

FIG. 9.
Fruits of *G. thunbergianum* (a, b), *G. spurium* ssp. *africanum* (c, d), and *G. chloroionanthum* (e, f). a, c: × 25; d, b: × 100; e: × 30; f: × 120. Explanations in the text.

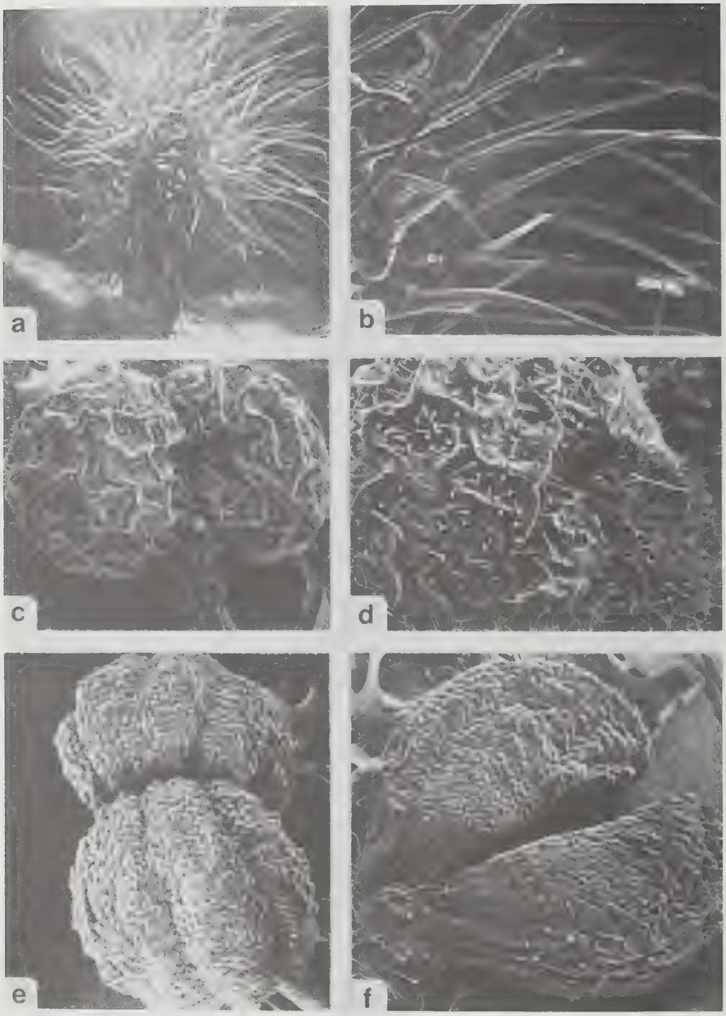

Fig. 10.
Fruits of *G. scabrelloides* (a, b), *G. subvillosum* var. *subvillosum* (c, d), and *G. tomentosum* (e, f). a: × 30; b: × 200; c: × 10; d: × 30; e, f: × 20. Explanations in the text.

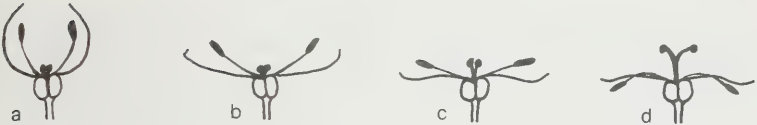

FIG. 11.
Schematic representation of mechanism preventing self-pollination in *G. subvillosum.* Further explanations in the text.

were found to produce nectar in profusion; only in *G. spurium* ssp. *africanum* do the tiny disks apparently produce very little nectar. *G. capense* ssp. *garipense, G. scabrelloides* and *G. thunbergianum* have slightly protandrous flowers. In *G. mucroniferum* and *G. subvillosum*, however, protandry is particularly pronounced (Fig. 11): pollen is released as soon as the flower opens (Fig. 11a). After one or two days the filaments begin to move into a more or less horizontal position; at this stage stigmas are not yet fully developed, and the styles have not yet elongated ("male state" of the flower, Fig. 11b; also see Fig. 8e, f). After approximately three days the styles slowly begin elongating (Fig. 11c); four to six days after the opening of the flower the styles have reached their full length, and the stigmas are ready for pollination ("female state" of the flower). Meanwhile the filaments have bent down below the level of the corolla lobes (the anthers by now are empty or almost empty; Fig. 11d).[1]

Similar mechanisms promoting allogamy have already been recorded for other *Galium* species by Müller (1873, Fig. 135: *G. verum*) and Kirchner (1911, Fig. 37: *G. mollugo*).

DELIMITATION OF THE GENUS

The genus *Galium* L. belongs to the tribe *Rubieae*. The only other genus of this tribe represented in Southern Africa is *Rubia* with the taxa *R. cordifolia* L. ssp. *conotricha* (Gandoger) Verdc., *R. petiolaris* DC., *R. horrida* (Thunb.) Puff (recently transferred from *Galium*: Puff, 1978), and the introduced *R. peregrina* L. (according to Sonder, 1865; no specimens seen by me). It is distinguished from *Galium* (as far as Southern African material is concerned) by much longer leaves with well developed petioles (excluding *R. peregrina*), 5-merous corollas and more or less fleshy fruits.

TAXONOMY

Galium L.[2]

Perennial herbs or annuals. Stems more or less distinctly 4-angled (sometimes more or less terete near the base), glabrous or beset with hairs or reversed prickles. Leaves and leaf-like stipules in whorls of 4–10, epetiolate. Synflorescences many-to few-flowered. Flowers perfect, or imperfect (plants dioecious); corollas 4-merous, rotate, yellow to whitish; calyx absent; stamina 4, as long as or shorter than the corolla lobes; ovary inferior, stigmas capitate; fruits consisting of two globose, subglobose or more or less reniform mericarps, dry, glabrous or with hooked or straight hairs.

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[1] Based on observations of plants cultivated in a garden in Pietermaritzburg. Results were consistent in all plants examined.

[2] Description valid only for the Southern African members of the genus.

KEY TO THE SPECIES AND SUBSPECIES

1. Middle cauline leaves in whorls of 4, 3-nerved .... 1. **G. thunbergianum** Botsw
Middle cauline leaves in whorls of 6–10, 1-nerved 2
2. Synflorescences very reduced, paracladia with one or two groups of 3–1 flowers ... 3
Synflorescences ± extensive, paracladia many-flowered 8
3. Leaves large, up to 38(45) mm long and (12)15 mm wide, with reversed prickles on the margins; fruits with hooked hairs 4
Leaves small, up to 14 mm long and 3 mm wide, without prickles on the margins; fruits glabrous or with straight, not hooked hairs 5
4. Fruit hairs brownish, ca. 1 mm long, flattened, very densely spaced; pedicels 0,5–1 mm long .... 13. **G. chloroionanthum** Trop
Fruit hairs white, less than 0,5 mm long, not flattened, well spaced; pedicels (8)12–20(35) mm long .... 14. **G. spurium** ssp. **africanum**
5. Leaves large, up to 14 mm long and 3 mm wide; longest internodes 10–45(55) mm; fruiting pedicels up to 10(13) mm long; corolla (2,5)3–4 mm in diameter 6
Leaves small, up to 5(6) mm long and 1,2 mm wide; longest internodes 1–10(15) mm; fruiting pedicels up to 1(2) mm long; corolla 1,5–2 mm in diameter 7
6. Paracladia with 3–6 flowers arranged in groups of 3; fruiting pedicels (3)4–6(8) mm long .... 9. **G. subvillosum** S.W.Ca
Paracladia with 2–4 flowers arranged in groups of 2; fruiting pedicels (4)6–10(13) mm long ....(25).............. 10. **G. mucroniferum** S.W.Ca
7. Longest internodes 1–5(6) mm; leaves up to 2,5 mm long, glabrous; paracladia 3–1-flowered .... 4. **G. bredasdorpense** Bredas
Longest internodes 8–10(15) mm; leaves up to 5(6) mm, with ± long, white spreading hairs; paracladia only 1-flowered .... 5. **G. amatymbicum**
8. Flowers imperfect, plants dioecious, peduncles and pedicels villous .... 12. **G. tomentosum** SWA, C
Flowers perfect, peduncles and pedicels glabrous, scabrous, or with a few, ± straight white hairs, but never villous 9
9. Leaves obovate to obovate-oblong, (6)8–10(11) mm wide, often glaucous, always in whorls of 6; flowers with very short stamina (anthers almost sessile) .... 11. **G. undulatum** Cape
Leaves linear, lanceolate or (narrowly) oblanceolate, (0,6)0,8–4(5) mm wide, never glaucous, in whorls of 6–8–10; flowers with stamina ca. half as long as the corolla lobes 10
10. Leaves with densely set reversed prickles on the margin; pedicels hairy with ± long, straight white hairs or glabrous 11
Leaf margins glabrous, with ± long, straight white hairs or only very few, small reversed prickles; pedicels glabrous or scabrous 12
11. Longest internodes (25)30–65(75) mm; mericarps typically hairy with straight, white hairs; leaves up to 4(5) mm wide; South Africa, Lesotho, Swaziland .... 7. **G. scabrelloides**
Longest internodes 20–25 mm; mericarps glabrous; leaves not wider than 2(2,5) mm; from tropical East Africa extending into Rhodesia .... 8. **G. scabrellum**
12. Leaves (18)20–30 mm long; from tropical East Africa extending into Rhodesia .... 6. **G. bussei** Trop Afr.
Leaves (3)5–20(23) mm long; South Africa, Lesotho 13

13. Stems densely covered with short, spreading hairs; leaves 0,6–0,8(1) mm wide, surfaces densely covered with ± long, white spreading hairs; corolla (1,5)1,7–2(2,3) mm in diameter .... 3. **G. monticolum**
Stems glabrous, with minute prickles or very short, curled whitish hairs; leaves (0,3)0,5–2(2,5) mm wide, surfaces smooth or with small, forward-directed prickles or short straight hairs; corolla 2–3,5(4) mm in diameter 14
14. Leaves with small, forward-directed prickles or short, straight hairs on the surfaces; pedicels scabrous (or subglabrous) ...... 2B. **G. capense** ssp. **namaquense**
Leaves glabrous or with a few reversed prickles on the margin; pedicels always glabrous 15
15. Mericarps glabrous; leaves up to 12(15) mm long ...... 2A. **G. capense** ssp. **capense**
Mericarps ± densely covered with short, curled whitish hairs (rarely subglabrous); leaves up to 20(23) mm long .... 2C. **G. capense** ssp. **garipense**

1. **G. thunbergianum** Eckl. & Zeyh., Enum. Pl. Afr. Austr.: 369 (1836). Type: South Africa, "Ceded Territory" (= SE. Cape Prov.), Katriviersberg, *Ecklon & Zeyher 2321* (S!, SAM!; NU, WU: photos!).

G. rotundifolium sensu Thunb., Fl. Cap. **1:** 551 (1813), non L.

G. rotundifolium sensu Sonder in Fl. Cap. **3:** 39 (1865), non L.

G. rotundifolium L. var. *hirsutum* Sond. in Fl. Cap. **3:** 39 (1865). Type: South Africa, Cape Prov., *Masson* in herb. Thunberg sub no. *3354* (UPS!; NU, WU: photos!).

G. rotundifolium L. var. *normale* O.Ktze., Rev. Gen. Pl. **3**,2: 120 (1898). Type: South Africa, Natal, Van Reenen's Pass, 1800 m, *O. Kuntze s.n.* (K!).

G. dayscarpum Schweinf., Beitr. Fl. Aethiop.: 135 (1867). Type: Ethiopia, Simien, Debra-Eski, *Schimper* (B).

G. biafrae Hiern in Fl. Trop. Afr. **3:** 245 (1877). Types: Fernando Po, *Mann 605* & Cameroun Mtn., *Mann 1284* (both K).

G. natalense Rouy in Fl. Fr. **8:** 9 (1903), adnot. Type: South Africa, Natal, Drakensberge, Van Reenen Pass, *Medley Wood 5562* (LY; K: photo).

Perennial with extensive rhizome. Stems climbing, suberect or procumbent, (80)100–400(600) mm long, with ± few lateral branches; 0,5–1(1,5) mm in diam., distinctly 4-angled, glabrous or with short, ± spreading white hairs. Longest internodes (15)25–50(65) mm. Middle cauline leaves in whorls of 4, 3-nerved, (7)10–18(22) × (3,5)4–8(10) mm, (roundish-)ovate, elliptic or ± rhombic, ± acute or with a short hyaline point at the apex, ± cuneate at the base; glabrous or with short, ± spreading hairs on both surfaces and on the flat margins. Synflorescences broadly pyramidal to ± cylindrical, paracladia ± many-flowered, ultimate branches with 1–2 minute bracts; pedicels 1–3(5) mm, slightly elongating after anthesis, glabrous or hairy, ± divaricate in fruit. Flowers slightly protandrous, 4-merous; corolla (1)1,5–2,5(3) mm in diam., rotate, often with a few short hairs outside, greenish, greenish-white, pale yellow, or yellow; lobes longer than wide, ± ovate; stamina ca. half as long as the lobes, filaments ± filiform, anthers elliptic; styles ca. $^1/_2$ to $^1/_3$ fused. Fruits dry, densely covered with white tuberculate hooked hairs; mericarps subglobose, each (0,8)1–1,5 mm wide.

Two varieties recognized:

1a. var. **thunbergianum**

G. natalense Rouy in Fl. Fr. **8:** 9 (1903), adnot. Type: South Africa, Natal, Drakensberge, Van Reenen Pass, *Medley Wood 5562* (LY; K: photo).

G. rotundifolium L. var. *normale* O.Ktze., Rev. Gen. Pl. **3**,2: 120 (1898). Type: South Africa, Natal, Van Reenen's Pass, 1800 m, *O. Kuntze s.n.* (K!).

Stems, leaves, peduncles and pedicels glabrous or nearly so (occasionally a few hairs at some of the upper nodes or along the nerves of the leaves).

Chromosome Number: n = 11, 2n = 22.

Habitat: In forest margin vegetation (but rarely in forests), on stream banks, under rock overhangs, or in rocky grassland. Generally in damp to wet, ± rich soil and sheltered, ± shady locations. Ca. 900–2 350 m.

Flowering Period: December to March (April).

Distribution (maps, Figs 12, 13): In the mountains of West Kenya and Ethiopia, and Southern Africa (East Rhodesia, East and South Transvaal, Swaziland, Natal, Lesotho, Orange Free State and Eastern Cape Province).

1b. var. **hirsutum** (Sond.) Verdc. in Kew Bull. **30:** 326 (1975).

G. rotundifolium L. var. *hirsutum* Sond. in Fl. Cap. **3:** 39 (1865). Type: South Africa, Cape Prov., *Masson* in herb. Thunberg sub no. *3354* (UPS!; NU, WU: photos!).

G. rotundifolium sensu Thunb., Fl. Cap. **1:** 551 (1813), non L.

G. dayscarpum Schweinf., Beitr. Fl. Aethiop.: 135 (1867). Type: Ethiopia, Simien, Debra-Eski, *Schimper* (B).

G. biafrae Hiern in Fl. Trop. Afr. **3:** 245 (1877). Types: Fernando Po, *Mann 605* & Cameroun Mtn., *Mann 1284* (both K).

Stems (mainly angles), leaves, peduncles and pedicels ± densely covered with short, straight, ± spreading white hairs.

Chromosome Number: n = 11, 2n = 22.

Habitat and Flowering Period: As in var. *thunbergianum.*

Distribution (maps, Figs 12, 13): From tropical Africa (Sudan, Ethiopia, Fernando Po, Cameroun: Cameroun Mtn., Zaire, Uganda, Kenya and Tanzania) to Southern Africa, where it occurs in East Rhodesia, North, North East and South Transvaal, Swaziland, Natal, Lesotho, Orange Free State and Eastern Cape Province.

Critical Remarks: While var. *thunbergianum* is very much rarer than var. *hirsutum* in tropical Africa (cf. Verdcourt, 1976), both varieties are more or less equally well represented in Southern Africa. Although they were often found growing side by side in the field, intermediate (± hairy) forms were never detected. The subdivision of the species into two varieties, therefore, seems justified.

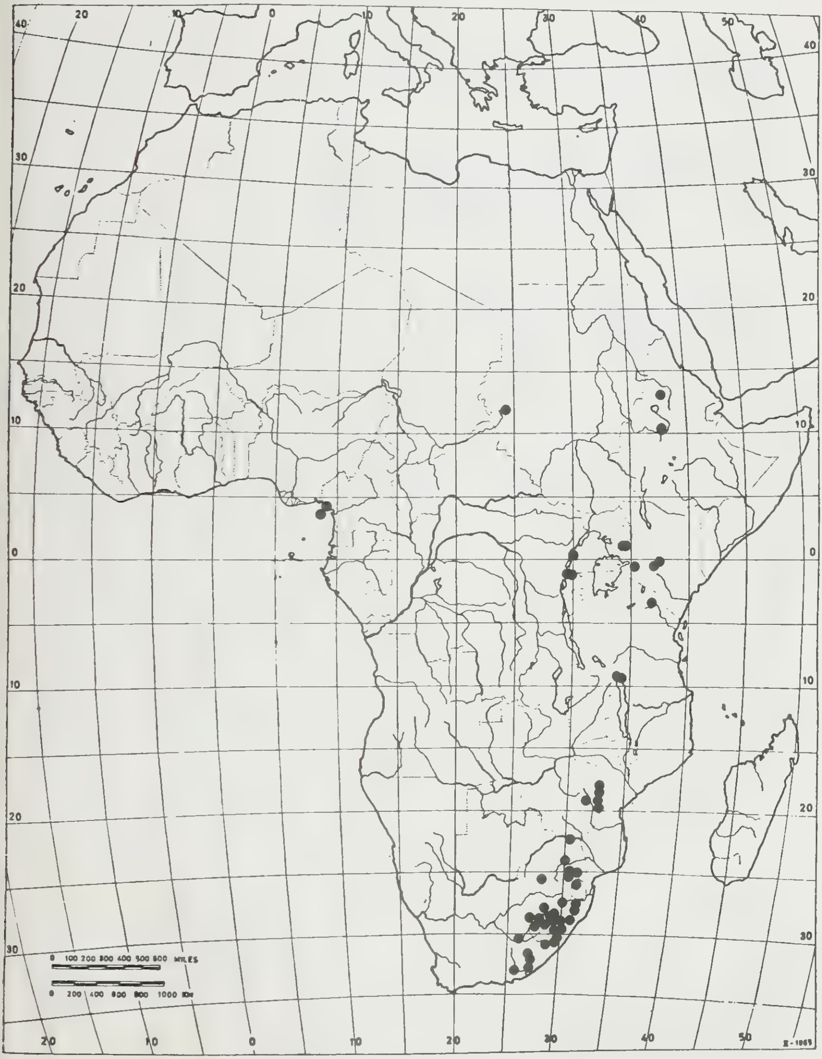

FIG. 12.
Distribution of *G. thunbergianum*
(var. *thunbergianum* and var. *hirsutum*).

G. thunbergianum is very variable, particularly leaf size and shape (cf. Fig. 5b) and extent of the synflorescence may differ greatly. Since variation, however, is considerable even within a single population and leaf and synflorescence variation is not correlated at all, a further subdivision of the species does not seem appropriate.

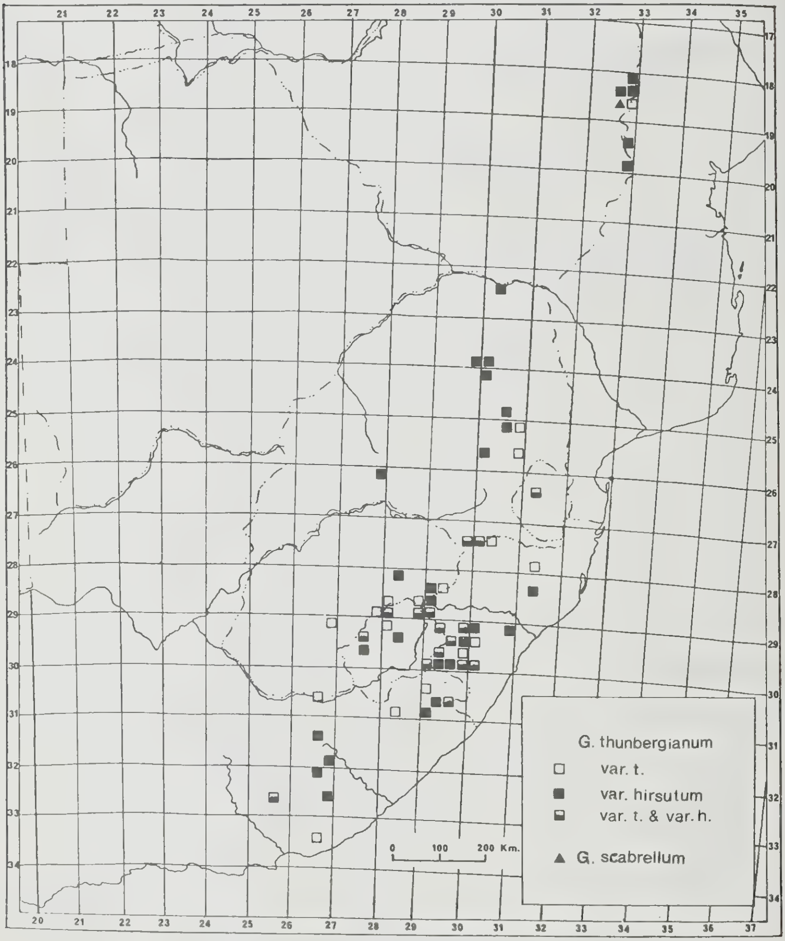

FIG. 13.
Distribution of *G. thunbergianum* var. *thunbergianum* and var. *hirsutum*, and *G. scabrellum* in Southern Africa.

COLLECTIONS

var. *thunbergianum*

RHODESIA—1832: Inyanga distr. Stapleford, Nuza Slopes, ca. 1 830 m (-DB), *Wild 5706* (LISC, SRGH).

TRANSVAAL—2530 (Lydenburg): ca. 3 m from Whiskeyspruit on old Sabie-Lydenburg rd., ca. 1 830 m (-BB), *Meeuse 10331* (PRE, S); 5 m from Kaapsehoop to Ngodwana (-DB), *Buitendag 823* (NBG).

——2729 (Volksrust): Farm "Highlands", Volksrust distr., ca. 1 700 m, *Mogg 7521* (PRE).

——2730 (Vryheid): Wakkerstroom, ca. 1 830 m (-AC), *Beeton 205* (SAM); Farm "Oshoek" nr. Wakkerstroom, ca. 2 000 m, *Devenish 799* (PRE); "South Hill" summit, ca. 2 300 m, *Galpin 9830* (PRE); Kastrol Nek (-AD), *Fitzsimmons & Van Dam 26061* (PRE).

ORANGE FREE STATE—2827 (Senekal): Doorn Kop (-DD), *Burke s.n.* (K), *Zeyher 772* (K).

——2828 (Bethlehem): Farm "Dunelin" nr. Fouriesburg (-CA), *Potts 3088* (NBG, PRE); Witsieshoek (-DB), *Junod 17448* (PRE); Bester's Vlei, ca. 1 500 m, *Bolus 8171* (BOL), *Flanagan 1866* (P, SAM).

——2926 (Bloemfontein): Thaba Nchu Mtn., Cave Kloof forest, ca. 2 100 m (-BB), *Roberts 2284* (PRE).

SWAZILAND—2631 (Mbabane): Hills N of Mbabane, ca. 1 380 m (-AC), *Compton 28691* (PRE, SRGH); Mbabane distr., Duiker Bush, ca. 1 500 m, *Compton 25596* (NBG).

NATAL—2731 (Louwsburg): Ngome (-CD), *Strey 9557* (NH).

——2828 (Bethlehem): Royal Natal National Park, Mont-aux-Sources, Pastures Busch, ca. 1 830 m (-DD), *Bayer & McLean 120* (PRE);—, Tugela valley and Mont-aux-Sources, ca. 1 500–2 000 m, *Humbert 14862* (P), *15015* (P).

——2829 (Harrismith): E of Van Reenen, 1 700 m (-AD), *Jacobsz 1562* (NBG); Van Reenen pass, 1 800 m, *Kuntze s.n.* (K), *Krook 2058* (S), *Medley Wood 5662* (LY); Umlambonja valley (-CC), *Marriott s.n.* sub PRE *22654* (PRE).

——2929 (Underberg): Giant's Castle Game Reserve, "Main Cave" (-AB), *Puff 761221–2/1* (WU); Cathedral Peak Forest Reserve, catchment 9, ca 1 800–2 000 m, *Puff 760314–4/2* (WU); Cathkin Park, floor of Ndema forest, ca. 1 370 m, *Galpin 11890* (PRE); Bushman's R. nr. Dalton Bridge, ca. 1 400 m (-BB), *Wright, West & Acocks 3* (NH); Loteni Forest Reserve, S branch of Loteni R. (-BC), *Wright 1475* (NU); Farm "Allandale", adjacent to Kamberg Nature Reserve, ca. 2 100 m, *Puff 761220–2/1* (WU); Bamboo Mtn. (-CB), *McLean 681* (NH); nr. Bushmen's Nek Police Post (-CC), *Hilliard & Burtt 7985* (E, K, MO, NU, S); Bushmen's Nek nr. Thamathu Cave, ca. 2 300 m, *Hilliard & Burtt 8922* (E, K, NU, PRE); Garden Castle Nature Reserve, valley of Umzimkulu R., ca. 1 800 m, *Hilliard & Burtt 7897* (E, K, MO, NU); summit of Nhlosane Mtn., nr. Dargle (-DB), *Puff 761125–3/5* (WU); 3 m from Donnybrook on Ixopo rd., ca. 1 400 m (-DD), *Edwards 3107* (NU, PRE); Polela, *Medley Wood s.n.* (SAM).

——2930 (Pietermaritzburg): 6 m from Balgowan/Curry's Post, ca. 1 350 m (-AC), *Moll 890* (NU, PRE); Keerom, Farm "Cottingham", ca. 1 380 m (-CC), *Strey 8415* (NH, SRGH).

——3029 (Kokstad): Weza, Ingeli slopes (-DA), *Strey 6305* (K, NH, NU);—, Zuurberg, nr. Transkei Border *Puff 760509–4/5* (WU).

LESOTHO—2828 (Bethlehem): Leribe, ca. 1 500–1 800 m (-CC), *Dieterlen 146* (K, PRE, S, SAM); —, Lefi's Kloof on NE slopes of Leribe Plateau, *Phillips 972* (SAM); —, W slopes of Leribe Plateau, *Phillips 749* (SAM).

——2927 (Maseru): Roma, ca. 1680 m (-BC), *Ruch 1795* (PRE).

——2928 (Marakabei): Nsututse, ca. 2 440 m (-AA), *Jacot Guillarmod 1242* (PRE).

Uncertain locality: "S slope in ravine", *Schmitz 434* (PRE).

CAPE—3026 (Aliwal North): Aliwal North (-DA), *Hepburn 279* (GRA).

——3028 (Matatiele): Potrivier Berg, ca. 1 680 m (-CD), *Galpin 6650* (BOL, GRA, K, NH, PRE, SAM).

——3029 (Kokstad): Invenyani nr. Cedarville (-AC), *Bandert 200* (GRA).

——3225 (Somerset East): Bosberg, ca. 1 070 m (-DA), *McOwan 1537* (BOL).

——3226 (Fort Beaufort): "Ceded Territory", Katriviersberg (-D?), *Ecklon & Zeyher 2321* (S, SAM).

——3326 (Grahamstown): Grahamstown (-BC), *Glass 830* (NBG).

Uncertain locality: "Cape of Good Hope", *Cooper 2495* (K).

COLLECTIONS

var. *hirsutum*

RHODESIA—1832: Inyanga distr., Inyangani Mtns. (-BB), *Norlindh & Weimarck 5036* (SRGH); —, Inyanga Down (-BC), *Norlindh & Weimarck 4740* (SRGH); —, Chipungu Falls (-BD), *Chase 4349* (SRGH).

——1832/1932: Umtali distr., Engwa, 1 980 m, *Exell, Mendonça & Wild 306* (LISC, SRGH).

——1932: Umtali distr., Himalaya Mtns., ca. 1 950 m (-BD), *Wild 4444* (LISC, SRGH); Melsetter distr., near Bridal Veil Falls (-DD), *Noel 2437* (LISC, PRE, SRGH).

TRANSVAAL—2230 (Messina): Hooge Veld, Pages Hotel (-AC), *Rehmann 6862* (K).

——2329 (Pietersburg): Houtboschberg, 2 160 m (-DD), *Schlechter 4387* (BOL, PRE, S, SAM, W, WU), *4718* (GRA, NBG, S, SAM, W, WU).

——2330 (Tzaneen): Wolkberg Bosreserwe, path from Wolkberg to the "Knuckles" (-CC), *Puff 770109–2/3* (WU).

——2430 (Pilgrim's Rest): The Downs, ca. 1 200 m (-AA), *Junod 4270* (PRE), 19973 (PRE); Pilgrim's Rest, Black Hill, ca. 2 050 m (-DC), *Galpin s.n.* (BOL).

——2530 (Lydenburg): Mt. Anderson, 11,5 m W of Sabie (-BA), *Strey 3042* (PRE, SRGH); Belfast (-CA), *Leedertz 9205* (PRE).

——2627 (Potchefstroom): Krugersdorp (-BB), *Jenkins 9263* (PRE).
——2730 (Vryheid): Farm "Oshoek" nr. Wakkerstroom, nr. Natal border (-AC), *Puff 770102–2/1* (NU, WU).

Uncertain or inexact localities: Warmbad distr., no locality given, *Leipodt s.n.* sub PRE *42009* (PRE); Waterberg distr., W end of Waterberg Mtns., Farm Groothoek, ca. 1 800 m, *Codd 3964* (PRE).

ORANGE FREE STATE—2828 (Bethlehem): Bethlehem (-AB), *Potgieter 21850* (PRE); Bethlehem distr., Farm "Rondehoek", ca. 1 700 m, *Scheepers 1763* (PRE).

Inexact locality: "OFS", *Cooper 2497* (E, K).

SWAZILAND—2631 (Mbabane): Hills N of Mbabane, ca. 1 380 m, *Compton 28691* (NBG).

NATAL—2729 (Volksrust): nr. Charlestown, ca. 1 500–1 800 m (-BD), *Medley Wood 5566* (GOET); Farm "Glen Atholl" nr. Charlestown and Volksrust, ca. 1 800 m *Smith 5693* (PRE); Majuba, *Rogers 3310* (PRE).
——2730 (Vryheid): Vryheid distr., Farm Kambula, *Gerstner 4632* (PRE).
——2828 (Bethlehem): Royal Natal National Park (-DD), Mont-aux Sources, *Steyn 1061* (NBG), ca. 1 800 m, *Bayer & McClean 120* (PRE), ca. 2 000 m, *Mogg 4247* (PRE), ca. 2 150 m, *Sim s.n.* sub PRE *42007* (PRE); —, Tugela valley and Mont-aux-Sources, ca. 1 600 m, *Humbert 14846* (P).
——2829 (Harrismith): Olivershoek pass, ca. 1 500 m (-CA), *Wood 3558* (BOL, E, NH, SAM), *Strey 9526* (NH); Cathedral Peak area (-CC), *Esterhuysen 10232* (BOL).
——2831 (Nkandla): Ulundi, ca. 1 500–1 800 m (-AD), *Evans 486* (NH).
——2929 (Underberg): Giant's Castle Game Reserve, nr. "Barne's Shelter" (-AB), *Puff 761212–1/2* (WU); Cathedral Peak Forest Reserve, Forest Research Station, catchment 3, ca. 1 900 m, *Killick 1358* (BOL, NH), —, catchment 9, ca. 1 800–2 000 m, *Puff 76031–1/1,—2/1* (WU); Cathkin Peak, ca. 1 400 m, *Galpin s.n.* (BOL); nr. Champagne Castle Hotel, ca. 1 650 m, *Acocks 10067* (NU, PRE); Bushman's R, nr. Dalton Bridge, ca. 1 400 m (-BB), *Wright, West & Acocks 3* (BOL); South Downs, ca. 1 500–1 800 m (-BB), *Evans 514A* (NH); Game Pass Farm, Gladstone's Nose ridge, at "Game Pass" bushmen shelter, ca. 1 800 m (-BC), *Puff 760418–1/4* (NU, WU), *–1/5* (NU, WU); Farm Allandale, adjacent to Kamberg Nature Reserve, ca. 1 900–2 000 m, *Puff 761220–1/1* (WU); Kamberg, ca. 2 000–2 100 m (-BD), *Wright 1784* (NU), *2116* (NU), *Puff 761219–5/1* (WU); Bamboo Mtn. (-CB), *Grice s.n.* (NU); Bushmen's Nek, nr. Thamathu Cave, ca. 2 300 m (-CC), *Hilliard & Burtt 8922* (E, K, NU, PRE); Garden Castle Nature Reserve, valley of Umzimkulu R., ca. 1 800 m, *Hilliard & Burtt 7897* (E, K, MO, NU); Castle Gardens, *Solomon 50* (NU); Underberg (-CD), *McClean 598* (NH); Coleford Nature Reserve, "Sunnyside Cottage", *Puff 761225–1/1* (WU); Marwaga Mtn., Farm "Sunset" (-DC), *Rennie 502* (NU); Bulwer-Donnybrook rd. (-DD), *Hilliard & Burtt 8036* (E, K, MO, NU, PRE, S).

——2930 (Pietermaritzburg): Weston (''Westtown'') (-AA), *Rehmann 7345* (K); Elandskop, Farm ''Strathavon'', ca. 1 500 m (-BB), *Ward 7645* (NU); Keerom (-CC), *Strey 10874* (NH), *10833* (NH, NU); Mooirivier distr., *Johnston 578* (E), *816* (E).

——3029 (Kokstad): Weza, Zuurberg, nr. Transkei border (-DA), *Puff 760509–1/7* (NU, WU).

Inexact localitites: ''Natal and Zululand'', *Gerrard 1338* (K, W; as ''Port Natal'', *Gerrard & M'Ken 1338* in S); ''Natal'', *Cooper 2496* (E, K).

LESOTHO—2828 (Bethlehem): Leribe, ca. 1 500–1 800 m (-CC), *Dieterlen 146* (K, NH, PRE, SAM); —, mountain slopes S of Mission Station, *Phillips 688* (PRE, SAM); —, W slopes of Leribe Plateau, *Phillips 749* (SAM).

——2927 (Maseru): Mazenod (-BC), *Jacot Guillarmod 799* (PRE); Morija (-DA), *Page 15964* (BOL).

——2928 (Marakabei): Bokong Stores, ca. 2 350 m (-AC), *Jacot Guillarmod 160* (PRE).

——2929 (Underberg): Sani Pass-Mokhotlong rd., base of Black Mtn. (-CB), *Puff 761209–7/12* (WU); Sehlabathebe, 2 300–2 500 m (-CC), *Jacot Guillarmod, Getcliffe & Mzamane 315* (GRA, PRE).

CAPE—3029 (Kokstad): Kokstad, ca. 1 520 m (-CB), *Mogg 5190* (PRE); Insiswa Mtn., 2 000 m (-CC), *Schlechter 6450* (W, WU), *Krook 2056* (W), *10595* (PRE).

——3126 (Queenstown): Stormberg, Penhoek Pass, ca. 1 830 m (-BC), *Acocks 18668* (PRE, SRGH); summit of Hangklip Mtn., ca. 2 100 m (-DD), *Roberts 2046* (PRE).

——3225 (Somerset East): near Somerset East (-DA), *Scott Elliot 357* (E); Bosberg, ca. 910 m, *McOwan 1414* (BOL).

——3226 (Fort Beaufort): mountain top at Oxton, ca. 1 460 m (-BA), *Galpin 8360* (GRA, PRE); Keiskammahoek-Hogsback rd., ca. 2 m from Hogsback village (-DB), *Puff 760904–1/1* (WU).

Uncertain localities: ''Cala district'', *Pegler 1793* (PRE); ''Faku's Territory'', *Sutherland s.n.* (K).

2. **G. capense** Thunb., Prod. Pl. Cap. **1:** 30 (1794). Type: South Africa, Cape Prov. (''CBS''), *Thunberg* in herb. Thunberg sub no. *3308* (UPS!; NU, WU: photos!).

G. mucronatum Thunb., Prod. Pl. Cap. **1:** 30 (1794). Type: South Africa, Cape Prov. (''CBS''), *Thunberg* in herb. Thunberg sub no. *3342* (UPS!; NU, WU: photos!).

G. expansum Thunb., Prod. Pl. Cap. **1:** 30 (1794). Type: South Africa, Cape Prov. (''CBS''), *Thunberg* in herb. Thunberg sub no. *3312* (UPS!; NU, WU: photos!).

G. capense var. *expansum* (Thunb.) Sond. in Fl. Cap. **3:** 36 (1865).

G. expansum var. *elongatum* Eckl. & Zeyh., Enum. Pl. Afr. Austr.: 370 (1836). Type: South Africa, Cape Prov., between "Hassaquaskloof" and "Breederivier", *Ecklon & Zeyher 2326β* (BOL!, SAM!; WU: photo!).

G. mucronatum var. *densiflorum* Eckl. & Zeyh., Enum. Pl. Afr. Austr.: 370 (1836). Type: South Africa, Cape Prov., "Vierentwintig Rivieren", *Ecklon & Zeyher 2327β* (GOET!, P!, SAM!, W!; WU: photo!).

G. mucronatum var. *subglabrum* Eckl. & Zeyh., Enum. Pl. Afr. Austr.: 370 (1836). Type: South Africa, "Tambukiland" (= Eastern Cape Prov.), on the right side of the "Keyrivier" (= Kei R.), *Ecklon & Zeyher 2327γ* (GOET!, P! SAM!, W!; WU: photo!).

G. namaquense Eckl. & Zeyh., Enum. F. Afr. Austr.: 369 (1836). Type: South Africa, Cape Prov. near "Heerelogement" (Heerenlogement), *Ecklon & Zeyher 2322* (S!, SAM!; WU: photo!).

G. garipense Sond. in Fl. Cap. **3:** 37 (1865). Types: South Africa, Cape Prov., "on the Garip near Buffelvallei", 4 000 ft., *Drège* (?= *Drège 7674*, K!, S!, W!); —, Natal, "Buffaloerivier", *Gerr. & M'K.* (?= Port Natal, *Gerrard & McKen 1340* in S!; as Natal & Zululand, *Gerrard 1340* in K!).

G. wittbergense Sond. in Fl. Cap. **3:** 37 (1865). Type: South Africa, Cape Prov., "rocky wet places in the Wittbergen", 6–7 000 ft. Jan. *Drège* (in herbarium Sonder).

G. capense var. *minus* Sond. in Fl. Cap. **3:** 36 (1865). Types: South Africa, Cape Prov. ("CBS"), *Thunberg* in herb. Thunberg sub no. *3342* (UPS!; NU, WU: photos!); —, —, Wolvekop, *Zeyher 773* (S!).

G. capense var. *scabrum* Sond. in Fl. Cap. **3:** 37 (1865). Types: South Africa, Cape Prov., Modderfonteinsberg, 4 000–5 000 ft., *Drège 7682* (E!, K!, P!, S!; WU: photo!); —, —, between Pedroskloof and "Lilly Fontein" (Leliefontein), 3 000–4 000 ft., *Drège 7683* (K!, P!; WU: photo!).

G. wittbergense var. *glabrum* Phillips in Ann. S. Afr. Mus. **16:** 113 (1917). Types: Lesotho, Leribe, *Phillips 713* (K!, SAM!); —, —, *Dieterlen 40* p.p. (SAM!, mixed with var. *wittbergense*).

Perennial with a sometimes slightly woody rootstock. Stems scrambling, sprawling or climbing, or ascending to erect, (80)150–900 mm long, with a few to many lateral branches; up to 4 mm in diam. and ± terete at the base, 0,5–3 mm in diam. and distinctly 4-angled in the mid-stem region; glabrous or with a few minute reversed prickles, or with ± short curled whitish hairs. Longest internodes (8)10–40 mm. Middle cauline leaves in whorls of 6–8(–10), 1-nerved, (3)5–20(23) × (0,3)0,5–2(2,5) mm, linear to narrowly lanceolate or oblanceolate, with a sometimes brownish-white mucro at the apex; surface sometimes shiny, glabrous or with small, forwardly directed prickles, or with short, straight hairs; margins often reflexed, glabrous or with a few reversed prickles. Synflorescences broadly pyramidal to ± cylindrical, paracladia ± many-flowered, flowers arranged in groups of (15)12–3(1), ultimate branches with (4)3–1 small, linear bracts or ebracteate; peduncles (1)1,5–3 mm, glabrous or scabrous, pedicels (1)1,5–4(5) mm, ± filiform, glabrous or scabrous, divaricate in fruit. Flowers 4-merous; corolla 2–4 mm in diam., rotate, (bright) yellow, creamy yellow, greenish-yellow or (rarely) whitish; lobes (much) longer than wide, acute or sometimes slightly acuminate; stamina ca. ¼ to ¾ of lobe length, filaments filiform; styles ½ to ¾ fused. Fruits dry, glabrous, ± tuberculate or granulate, or beset with short straight or curled whitish hairs; mericarps subglobose, each ca. 1–2 mm wide.

Preliminary Remarks:

Sonder's (1865) and my treatment of *Galium* differ considerably in regard to the delimitation of *G. capense*: according to Sonder the *Galium capense* "complex" consists of *G. capense* (with 4 varieties), *G. garipense* Sond. and *G. wittbergense* Sond.; in the present revision, however, *G. capense* is split up into three subspecies:

2A. ssp. *capense*
2B. ssp. *namaquense* (Eckl. & Zeyh.) Puff, and
2C. ssp. *garipense* (Sond.) Puff, with
    2Ca. var. *garipense* and
    2Cb. var. *wittbergense* (Sond.) Puff

G. capense var. *scabrum* Sond. (= *G. namaquense* Eckl. & Zeyh.) becomes *G. capense* ssp. *namaquense:* although sometimes difficult to keep apart morphologically from ssp. *capense*, it is separated geographically from the latter. *G. capense* s.str. is not subdivided further: all infraspecific names used by Sonder and other early authors are dropped because they stand for indistinguishable morphological forms. *G. garipense* cannot be kept apart specifically from *G. capense* s.str. (particularly in the Eastern Cape Province), and therefore is treated as the "Eastern" subspecies of the *G. capense* "complex". *G. wittbergense*, on the other hand, merely differs from ssp. *garipense* in its hairiness and has a ± identical distribution range: it is, therefore, considered a variety of ssp. *garipense*.

2A. **G. capense** ssp. **capense**

Type: see 2. *G. capense* Thunb.

G. mucronatum Thunb., Prod. Pl. Cap. **1:** 30 (1794). Type: South Africa, Cape Prov. ("CBS"), *Thunberg* in herb. Thunberg sub no. *3342* (UPS!; NU, WU: photos!).

G. expansum Thunb., Prod. Pl. Cap. **1:** 30 (1794). Type: South Africa, Cape Prov. ("CBS"), *Thunberg* in herb. Thunberg sub no. *3312* (UPS!; NU, WU: photos!).

G. capense var. *expansum* (Thunb.) Sond. in Fl. Cap. **3:** 36 (1865).

G. expansum var. *elongatum* Eckl. & Zeyh., Enum. Pl. Afr. Austr.: 370 (1836). Type: South Africa, Cape Prov., between "Hassaquaskloof" and "Breederivier", *Ecklon & Zeyher 2326β* (BOL!, SAM!; WU: photo!).

G. mucronatum var. *densiflorum* Eckl. & Zeyh., Enum. Pl. Afr. Austr.: 370 (1836). Type: South Africa, Cape Prov., ''Vierentwintig Rivieren'', *Ecklon & Zeyher 2327β* (GOET!, P!, SAM!, W!; WU: photo!).

G. capense var. *minus* Sond. in Fl. Cap. **3:** 36 (1865). Types: South Africa, Cape Prov. (''CBS''), *Thunberg* in herb. Thunberg sub no. *3342* (UPS!; NU, WU: photos!);—, —, Wolvekop, *Zeyher 773* (S!).

Perennial with a ± woody rootstock. Stems scrambling or climbing, (80)150–500(700) mm long, with few to many lateral branches; up to 4 mm in diam. and ± terete at the base, 0,5–1,5(2,5) mm in diam. and distinctly 4-angled in the mid-stem region, (at least younger parts) densely covered with short, curled, whitish hairs; often purplish. Longest internodes (8)10–35(40) mm. Middle cauline leaves in whorls of (6–)8(–10), 1-nerved, (3)5–12(15) × 0,5–1,5(2) mm, linear to narrowly lanceolate or oblanceolate, with a brownish-white mucro at the apex; surfaces often shiny, glabrous or occasionally with a few reversed prickles on the (strongly) reflexed margins. Synflorescences broadly pyramidial to ± cylindrical, paracladia usually many-flowered, flowers arranged in groups of (12)9–3(1), ultimate branches with (4)2–1 small bracts or ebracteate; peduncles (1)1,5–3 mm, glabrous, pedicels (1)2–4(5) mm, ± filiform, glabrous, usually strongly divaricate in fruit. Flowers 4-merous; corolla (2)2,5–4 mm in diam., rotate, bright to pale yellow; lobes much longer than wide, acute or sometimes slightly acuminate; stamina ca. half as long as the lobes, filaments thin; styles fused to the middle. Fruits dry, glabrous, ± tuberculate or granulate; mericarps subglobose, each ca. 1 mm wide.

Chromosome Number: Unknown. Diploid according to pollen measurements (cf. Fig. 2).

Habitat: In rocky grassland, in kloofs under rock overhangs, on ledges; sometimes in moist ground near watercourses. Usually in sheltered locations. Ca. 200-1 500(1 700) m.

Flowering Period: (August) September to December (January).

Distribution (map, Fig. 14): From the South West Cape extending to the Eastern Cape Province; also in Little, Great and Upper Karoo.

Critical Remarks: The morphological variability of ssp. *capense* is reflected in the large number of synonyms. They merely refer to weakish, rather atypical plants (*G. capense* var. *minus*) or to forms characterized by ± lax, broadly pyramidal synflorescences and long internodes (*G. expansum*, *G. capense* var. *expansum*, *G. expansum* var. *elongatum*) or ± dense, narrow synflorescences and short internodes (*G. mucronatum* var. *densiflorum*). As all these (extreme) forms are connected to each other by a series of morphological intermediates, it does not seem justified to uphold them taxonomically. The fairly uniform pollen diameters of morphologically rather divergent forms (Fig. 2b)—a good indication that one ploidy level prevails (presumably diploids; compare with pollen diameters of ssp.

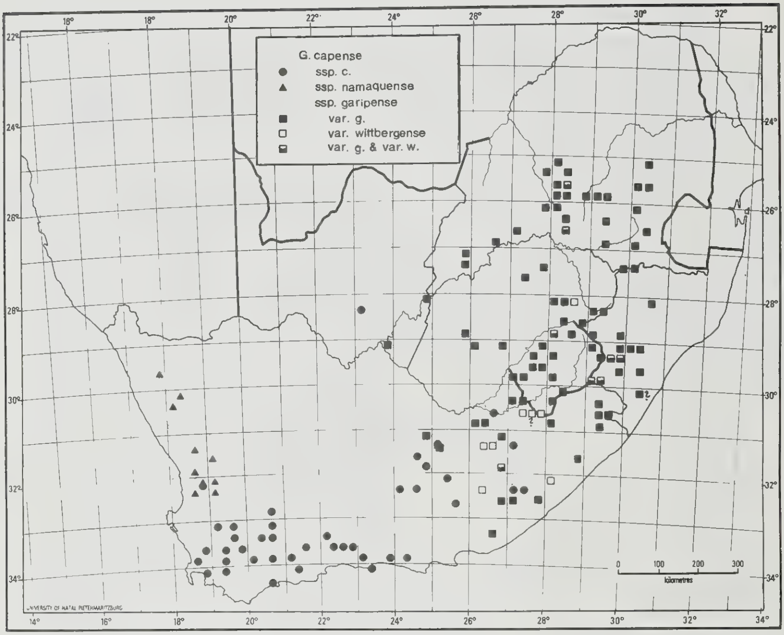

FIG. 14.
Distribution of *G. capense* ssp. *capense*, ssp. *namaquense*, and ssp. *garipense* var. *garipense* and var. *wittbergense*. Question marks: uncertain localities.

garipense)—are an additional argument against a further subdivision of ssp. *capense*.

For occasional problems encountered in delimiting ssp. *capense* from ssp. *namaquense* and ssp. *garipense* refer to the "Critical Remarks" section of the latter.

COLLECTIONS

CAPE—2823 (Griekwastad): at Bloem's Fontein (= Grootfontein) (-AC), *Burchell 2640* (GOET, K, P).

——3026 (Aliwal North): Eland's Hoek nr. Aliwal North, ca. 1 400 m (-DA), *Bolus 143* (BOL).

——3124 (Hanover): Richmond, Roelofsfontein (-DA), *Hanekom 1937* (PRE). Wapadsberg pass (-DD), *Maguire 715* (NBG).

——3125 (Steynsburg): nr. Middelburg (-AC), *Acocks 5536* (S).

——3126 (Queenstown): Molteno distr., Looperberg, ca. 1 600 m, *Mogg 2771* (PRE).

——3127 (Lady Frere): Clarksdale, Dordrecht (-AC), *Taylor 5648* (NBG).

——3218 (Clanwilliam): Clanwilliam (-BB), *Zeyher s.n.* (K).

——3220 (Sutherland): Klein Roggeveld, Oranjefontein, ca. 1 450 m (-DC), *Bond 17* (NBG); Sutherland distr., Vertaten Kloof (?spelling), *Adamson D130* (PRE).

——3224 (Graaff-Reinet): 25 m W of Graaff-Reinet, ca. 1 500–1 800 m (-AC), *Acocks 15865* (PRE; atypical); nr. Graaff-Reinet, ca. 700 m (-BC), *Bolus 139* (BOL, PRE); between Graaff-Reinet and Mussupburg, ca. 1 500–1 800 m, *Bolus* (?) *225* (BOL).

——3225 (Somerset East): Mountain Zebra National Park (-AB), *Brynard 150* (PRE); Bosberg, ca. 1 450 m (-DA), *Tofel* (?spelling) *416* (PRE).

——3227 (Stutterheim): ca. 7 m from Hogsback-Cathcart rd., Happy Valley, ca. 1 500 m (-AC), *Johnson 1268* (GRA); banks of Toise R., ca. 820 m (-AD), *Acocks 9413* (PRE).

——3318 (Cape Town): Paarlberg, ca. 300–600 m (-DB), *Drège s.n.* ("*G. expansum* Thunb.", E, K, P, S, W); Kanon Berg (-DC), *Salter 6447* (BOL, K); Tigerberg, Nov. 38, no collector given (?*Ecklon*) (W).

——3319 (Worcester): Winterhoekberg, ca. 300–600 m (-AA), *Drège 7680* (K, W); Vierentwintig Rivieren, *Ecklon & Zeyher 2327β* (GOET, P, SAM, W); Baviaansberg (-BA), *Stokoe s.n.* sub SAM *70003* (SAM), sub PRE *41989* (PRE), ca. 1 680 m, *Bond 1451* (NBG); between Hottentotskloof and Karroopoort (-BA, -BC), *Pearson 4818* (B, BOL, K); Hex R. Mtns., Prospect Peak (-BC), *Esterhuysen 15962* (BOL, PRE); Brandvlei, ca. 360 m (-CB), *Levyns 10775* (NBG); Worcester, 300 m, *Marloth 12560* (PRE); between Worcester and Villiersdorp, ca. 510 m (-CB, -CD), *Bolus 5061* (BOL); Louwshoek Mtn. (-CD), *Stokoe s.n.* sub SAM *59533* (SAM); Hex R. valley nr. De Doorns *Bolus 13123* (BOL); Boschjesveld nr. Mordkuil, on the Doorn R., below 300 m, *Drège 7685* (E, K, P, W); Koo (-DB), *Compton 3890* (BOL, NBG); Eendragt pass nr. Koo, ca. 1 070 m, *Levyns 7977* (BOL); Worcester distr., Andensberg, *Esterhuysen 3259* (BOL), *Compton 9743* (NBG);—, Keeromsberg, *Esterhuysen 9187* (BOL); Ceres distr., Bokkeveld Tafelberg, *Esterhuysen s.n.* sub BOL *31401* (BOL).

——3320 (Montagu): Pieter Meintjes, 1 150 m (-AD), *Marloth 10777* (PRE); Bantams, ca. 900 m (-BA), *Compton 12141* (NBG); Witteberg S of Bantams, ca. 1 370 m, *Esterhuysen 30488* (BOL); Matjiesfontein, Witteberg, ca. 1 070 m, *Compton 2806* (BOL, NBG); Witteberg, ca. 1 220 m, *Adamson s.n.* (BOL, K); Dobbelaars Kloof, ca. 760 m (-BC), *Levyns 6718* (BOL); Malagas, *Esterhuysen 4451* (NBG, PRE); Bonnievale, ca. 425 m (-CC), *Levyns 4589* (BOL); nr. Barrydale on Montagu rd., ca. 700 m (-DC), *Levyns 573* (BOL).

——3321 (Ladismith): Between Litte Vetter R. and Garcia's pass (-CC), *Burchell 6926* (K); W of Rooiberg pass, ca. 1 070 m (-DA), *Willems 1639* (NBG); Rooiberg pass, *Wurts 1611* (NBG); Swartberg, slopes below Kariegasberg, 1 300 m, *Thompson 2179* (PRE).

——3322 (Oudtshoorn): Swartberg pass (-AC), *Stokoe 8645* (BOL), ca. 1 030 m, *Wall 340* (S), *Acocks 1429* (S); —, 11 m E from top, ca. 1 370 m, *Stokoe s.n.* sub SAM *67539* (PRE, SAM); Langekloof, ca. 600–1 200 m (-CB), *Ecklon & Zeyher "100–12"* (S); Kommassie Mtns. ("Komanatsie Hills") (-DA, -DB), *Prior s.n.* (K).

——3323 (Willowmore): Brandhoek, on rd. from Kouga R., ca. 460 m (-CC), *Fourcade 5092* (BOL); Joubertina (-DD), *Horn s.n.* sub PRE *41964* (PRE).

——3324 (Steytlerville): on Kouga R., rd. from Suuranys ("Zuur Amys"), ca. 275 m (-CD), *Fourcade 3100* (BOL).

——3418 (Simonstown): Steenbras (-BB), *Rogers 17860* (PRE); Hottentots-Holland, *Gueinzius s.n.* (S); Hottentotsholland Kloof (= Sir Lowry's Pass), *Ecklon & Zeyher 2327* (W).

——3419 (Caledon): nr. Caledon (-AB), *Esterhuysen 4404* (BOL); Caledon Distr., *Cruse 49* (S).

——3420 (Bredasdorp): Malagas (-BC), *Esterhuysen 4451* (NBG, PRE).

——3421 (Riversdale): nr. Riversdale (-AB), ca. 180 m, *Muir 2942* (PRE), ca. 210 m, *Schlechter 1877* (GRA, PRE).

——3423 (Knysna): Plettenberg Bay (-AB), *Pappe s.n.* (K, S).

Uncertain, inexact or doubtful localities: Between "Hassaquaskloof" and "Breederivier", *Ecklon & Zeyher 2326β* (BOL, SAM); Wolvekop, *Zeyher 773* (S); from Tulbaghskloof (Nieuwekloof) to Pikenierskloof, ca. 150–300 m, *Drège "140.10"* (E); between Montagu and Triangle, *Barnard s.n.* sub SAM *32714* (SAM); in the Houthoek Mtns. and hills between Gauritz R. and Langekloof, *Ecklon 1836, 2326* (GOET, WU); between Swellendam and George, *Mundt (Ecklon & Zeyher) 91* (S); on the Fish R., ca. 1 370 m, *MacOwan 1627* (SAM); Stockenstrom, *Scott Elliot 344* (E); between Brakrivier and Uitvlugt, ca. 900–1 200 m, *Drège 7679* (K, P); "Kaffirland", *Barber s.n.* (S); "Regio orientalis" or "CBS", *Sparrman s.n.* (S), *Thunberg s.n.* (P, S), *Dahl s.n.* (S), *Prior s.n.* (K), *Thorn s.n.* (K), *Thorn 357* (K), *Scott Elliott s.n.* (E), *Meyer s.n.* (GOET); highly doubtful: Port Natal, *Gueinzius s.n.* (W); Durban, Natal, *Kassner 1716* (E).

2B. ssp. **namaquense** (Eckl. & Zeyh.) Puff, stat. nov.

G. namaquense Eckl. & Zeyh., Enum. Fl. Afr. Austr.: 369 (1836). Type: South Africa, Cape Prov., near "Heerelogement" (Heerenlogement), *Ecklon & Zeyher 2322* (S!, SAM!; WU: photo!).

G. capense var. *scabrum* Sond. in Fl. Cap. **3:** 37 (1865). Types: South Africa, Cape Prov., Modderfonteinsberg, 4 000–5 000 ft., *Drège 7682* (E!, K!, P!, S!; WU: photo!); —, —, between Pedroskloof and "Lilly Fontein" (Leliefontein), 3 000–4 000 ft., *Drège 7683* (K!, P!; WU: photo!).

Perennial with a slightly woody rootstock. Stems scrambling or sprawling, (150) 300–900 mm long, generally much-branched; 1–3 mm in diam., ± terete at the base, otherwise distinctly 4-angled, densely covered with very short, usually curled whitish hairs; often purplish. Longest internodes (20)25–40 mm. Middle cauline leaves in whorls of 6–8, 1-nerved, (4)6–8(10) × (0,5)1–2(2,5) mm, linear to narrowly lanceolate or oblanceolate, with a brownish-white mucro at the apex; upper and (sometimes) lower surface and margins (densely) covered with small, forwardly directed prickles or short, straight hairs; margins often reflexed. Synflorescences broadly pyramidal to cylindrical, paracladia ± many-flowered, flowers arranged in groups of (9)6–3, ultimate branches with 3–1 tiny, linear bracts; peduncles 1,5–2,5 mm, scabrous, pedicels (1)1,5–3(4) mm, ± filiform, scabrous or more rarely subglabrous, divaricate after anthesis. Flowers 4-merous; corolla (2)2,5–3,5 mm in diam., rotate, yellow or greenish-yellow; lobes longer than wide, acute; stamina short, ca. ¼ to ½ of lobe length, filaments filiform; styles short, fused to the middle. Fruits dry, beset with short, straight whitish hairs or glabrous, ± tuberculate or granulate; mericarps subglobose, each 1–2 mm wide.

Chromosome Number: Unknown. Diploid according to pollen measurements (cf. Fig. 2).

Habitat: Scrambling in dense vegetation of river banks, in arid fynbos, Renosterveld, or *Erica*-bush. Frequently in shady, ± sheltered locations and sandy soils. Ca. 725–1 500 m.

Flowering Period: (August, September) October to December.

Distribution (map, Fig. 14): Endemic to the Western Cape Province.

Critical Remarks: Although the morphological distinction between the polymorphic ssp. *namaquense* and ssp. *capense* may occasionally become rather difficult (sometimes indumentum is the only "good" separation character), it was decided to follow Ehrendorfer's (1952, unpublished) suggestions on sheets from the herbaria K and P to treat "*namaquense*" as a subspecies of *G. capense*. Its distinct and ± closed area of distribution (with hardly any overlap with ssp. *capense*) supports the subspecies rank rather than varietal status (the latter would possibly have been more appropriate if the taxon had been sufficiently scattered geographically).

COLLECTIONS

CAPE—2917 (Springbok): Modderfonteinsberg (-DB), *Drège 7682* (E, K, P, S, W).

——3018 (Kamiesberg): SW of Leliefontein (-AB), *Pearson 6302* (K); between Pedrosdorp and Leliefontein, ca. 900–1 200 m, *Drège 7683* (K, P, W); between Leliefontein and Ezelsfonteins, ca. 1 380 m (-AB, -AC), *Pearson 6319* (B, BOL; appr. ssp. *capense*); between Ezelsfontein and Kamiesberg, ca. 1 520 m, *Adamson 1470* (BOL, PRE; appr. *ssp. capense*); Kamiesbergen, Elliotsberg (-AC), *Crampton 7699* (BOL).

——3118 (Vanrhynsdorp): Giftberg, ca. 760 m (-BC), *Esterhuysen 22068* (BOL); Heerenlogement (-DC), *Ecklon & Zeyher 2322* (S, SAM).

——3119 (Calvinia): Lokenburg, 21 m S of Nieuwoudtville, ca. 760 m (-CA), *Story 4390* (GRA, PRE); ca. 1130 m, *Acocks 17374* (K, PRE).

——3218 (Clanwilliam): Pakhuis pass (-BB), *Salter 5042* (K), *Compton 4761* (NBG), *Thode A2119* (K, PRE); E base of Piquetberg (-BC), *Pillans 8641* (BOL, PRE; appr. ssp. *capense*).

——3219 (Wuppertal): Cedarberg, path to Middelberg plateau, ca. 850 m (-AA, -AC), *Levyns 2227* (BOL); —, Middelberg, *Bond 1327* (NBG), *Esterhuysen s.n.* sub NBG *23363* (NBG), *2487* (BOL), *2517* (PRE); —. Metjiesrivier, *Wagener 292* (NBG); Algeria Nature Reserve, Cedarberg, slopes of Vensterkop, ca. 730 m, *Taylor 7485* (PRE); Cedarberg Forest Reserve, NE base of Sneeuberg, ca. 900–1 200 m (-AC), *Taylor 6184* (PRE).

2C. ssp. **garipense** (Sond.) Puff, stat. nov.

G. garipense Sond. in Fl. Cap. **3:** 37 (1865). Types: South Africa, Cape Prov., "on the Garip near Buffelvallei", 4 000 ft., *Drège* (? = *Drège 7674*, K!, S!, W!); —, Natal, "Buffaloerivier", *Gerr. & M'K.* (? = Port Natal, *Gerrard & Mc'Ken 1340* in S!; as Natal & Zululand, *Gerrard 1340* in K!). See "Critical Remarks".

Perennial with a sometimes ± woody rootstock. Stems usually ascending to erect, (100)200–500(600) mm long, normally with ± few lateral branches; up to 3 mm in diam. and ± terete at the base, 0,8–2 mm in diam. and with 4 distinct, whitish angles in the mid-stem region; glabrous, with a few minute reversed prickles on the angles or with ± short, whitish hairs. Longest internodes 10–30(40) mm. Middle cauline leaves in whorls of 6–8, 1-nerved, (6)8–20(23) × (0,3)0,5–1(1,5) mm, linear, often with a ± distinct mucro at the apex; glabrous or sometimes with a few small reversed prickles on the often ± reflexed margin. Synflorescences broadly pyramidal to ± cylindrical, paracladia ± many-flowered, flowers arranged in groups of (15)12–3, ultimate branches with 1–2 small, linear bracts; peduncles 1,5–2,5 mm, glabrous, pedicels (1)1,5–3(4) mm, ± filiform, glabrous, divaricate in fruit. Flowers slightly protandrous, 4-merous; corolla 2–3,5(4) mm in diam., rotate, bright yellow, sometimes creamy-yellow, yellow-green or (rarely) whitish, lobes longer than wide, acute; stamina ca. ¾ of lobe length, filaments filiform; styles ½ to ¾ fused. Fruits dry, ± densely covered with short, curled whitish hairs (rarely subglabrous); mericarps ± globose, each 1–1,8 mm wide.

Two varieties recognized:

2Ca. var. **garipense**

G. mucronatum var. *subglabrum* Eckl. & Zeyh., Enum. Pl. Afr. Austr.: 370 (1836). Type: South Africa, "Tambukiland" (= Eastern Cape Prov.), on the right side of the "Keyrivier" (= Kei R.), *Ecklon & Zeyher 2327γ* (GOET!, P!, SAM!, PRE, W!; WU: photo!).

G. wittbergense var. *glabrum* Phillips in Ann. S. Afr. Mus. **16**: 113 (1917). Types: Lesotho, Leribe, *Phillips 713* (K!, SAM!); —, —, *Dieterlen 40* p.p. (SAM!, mixed with var. *wittbergense*).

Stems glabrous or occasionally with a few minute, reversed prickles on the angles.

Chromosome Number: n = 11, 2n = 22.

Habitat: In vleis, along stream banks, on steep, well-drained (moist) rocky slopes, or in open grassland; sometimes in disturbed ground (road-sides, etc.). Usually in sun-exposed situations or in semi-shade. Ca. (500)1 100–3 000 m.

Flowering Period: (September) October to January (February).

Distribution (map, Fig. 14): From the Transvaal, Orange Free State, Lesotho, Natal Midlands and Uplands, Griqualand East and Transkei to the Eastern Cape Province.

2Cb. var. **wittbergense** (Sond.) Puff, stat. nov.

G. wittbergense Sond. in Fl. Cap. **3:** 37 (1865). Type: South Africa, Cape Prov., "rocky wet places in the Wittbergen", 6–7 000 ft. Jan. *Drège* (in herbarium Sonder; see "Critical Remarks").

Stems hairy, but without minute prickles on the angles.

Chromosome Number: n = 11, 2n = 22.

Habitat and Flowering Period: as in var. *garipense*.

Distribution (map, Fig. 14): From the Transvaal, South East Orange Free State, North Lesotho, Natal Midlands and Uplands to the Eastern Cape Province.

Critical Remarks: It is somewhat uncertain which specimens are to be considered the valid types of *G. garipense*: Sonder (1865) lists "on the Garip near Buffelvallei, 4 000 ft., Dec. *Drège*" as type. No *Galium*, however, was collected there by Drège (cf. Drège 1843, p. 50). Specimen *Drège 7674* ("Kraairivier, am und im Fluss, 4 500 Fuss, Januar"), on the other hand, is from a nearby locality and, moreover, corresponds well with the original description of *G. garipense*. It therefore seems likely that Sonder confused these two collecting sites (on specimen *Drège 7674* from the herbarium S the name "*Galium garipense* Sond." was written on the label by Sonder himself!). The second type is "Buffaloerivier, *Gerr. & M'K.*": this may well refer to the specimens Gerrard & *McKen 1340* and *Gerrard 1340* (in *Flora Capensis*, Sonder often for some inexplicable reason omitted collection numbers). These two specimens are probably from one collection: in several herbaria collections by Gerrard & McKen are often attributed to Gerrard only. The locality given for these identical specimens is either "Port Natal" on one set of labels or "Natal & Zululand" on another. The assumption that this collection is indeed a type is supported by the fact that the label of the Gerrard & McKen specimen from the herbarium S was written by Sonder himself. However, on the label he filled in "Port Natal" as locality and not "Buffaloerivier" as given in *Flora Capensis*.

The type of *G. wittbergense* originates from "rocky, wet places in the Wittbergen, 6–7 000 ft. Jan. *Drège*". According to Drège (1843, p. 52) this must be collection site I a. 54 ("Witbergen, an feuchten Oertern, grasreichen Thälern und in Felsschluchten, 6 000–7 000 Fuss, Januar") and specimen *Drège 7676*. I have been unable to trace this specimen. Although Sonder mentions that it is in his own herbarium, Dr. J. Ross (personal communication) could not find the collection at the herbarium MEL, where most of Sonder's herbarium is housed.

While specimens of *garipense* from more Eastern localities (Transvaal, Natal) are always clearly distinct from *G. capense* s.str., separation of the two taxa becomes rather troublesome where their ranges of distribution overlap (Eastern Cape Province). For that reason alone species status cannot be maintained for *garipense*. The latter is also not specifically distinct from *G. wittbergense*. Differential characters for the two taxa given by Sonder (1865, p. 37: *G. garipense* has "more diffuse habit, glabrous, often prickly stems, smaller spreading or reflexed leaves, and longer cymes") are not valid: after examination of ample herbarium material it becomes obvious that all these characters are variable. It would therefore seem best to reduce *wittbergense* to varietal rank and to include it in ssp. *garipense*.

G. capense ssp. *garipense*, like the other infraspecific taxa, is extremely variable in habit, branching pattern, internode length and extent of the synflorescence. Some forms (belonging to either of the two varieties) produce glabrescent gynoecea or fruits instead of hairy ones, and may therefore rather closely resemble ssp. *capense*.

A number of specimens from West Natal[1] differ from ssp. *garipense* (and ssp. *capense*) in having very many short lateral branches with internodes shorter than 10 mm, needle-like (not more than 0,5 mm wide) erect to spreading leaves arranged in whorls of (8–)10 and ± smaller flowers (not more than ca. 2 mm in diam.). As their position is not at present clearly understood, they have not been given formal recognition.

COLLECTIONS

ssp. *garipense* var. *garipense*

TRANSVAAL—2527 (Rustenburg): Bokfontein (-DB), *Jenkins 7545* (PRE). ——2528 (Pretoria): Apiesrivier, 1 600 m (-AA, -AD), *Rehmann 4241* (K), *Schlechter 3633* (BOL, PRE, SAM, W; ± atypical); Fairy Glen, ca. 1 460 m (-CA), *Mogg 17230* (PRE, SRGH); Pretoria, *Leendertz 3736* (PRE); Onderstepoort, *Theiler 9604* (PRE); Silverton (-CB), *Obermeyer 146* (PRE); between

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[1] 2929 (Underberg): Coleford Nature Reserve, "Sunnyside Cottage", ca. 1 500 m (-CD), *Moll 5157* (NH), *Puff 761225–2/1* (WU); Polela distr., Sunset, Lot 7, Marwaga Mtn., ca. 2 000 m (-DC), *Rennie 268* (NU).

Baviaanspoort and Vlakfontein (Mamelodi), ca. 1 370 m, *Smith 1078* (PRE); Irene (-CC), *Burtt Davy 734* (PRE), *Obermeyer 123* (PRE), *Rogers 11416* (K), *8661* (PRE), *Leendertz 668* (PRE); Rietvlei Reserve, ca. 1 520 m (-CD), *Repton 3251* (PRE); 16 m SE of Pretoria on rd. to Delmas, ca. 1 520 m, *Codd 3457* (PRE).

——2529 (Witbank): Witbank, ca. 1 610 m (-CC), *Rogers 24302* (GRA); Middelburg (-CD), *Jenkins 9859* (PRE); —, on the Klein Olifantrivier, *Du Plessis 842* (PRE), *Young A78* (PRE).

——2530 (Lydenburg): Nr. Lydenburg (-AB), *Wilms 574* (E, K); Belfast (-CA), *Williams 10252* (PRE); Waterval Boven (-CB), *Britten 4752* (PRE).

——2626 (Klerksdorp): Klerksdorp (-DC), *Convent 30* (GRA).

——2627 (Potchefstroom): Witkoppen (-BB), Pharmac. Lab., Univ. Witwatersrand *4691* (K); Isaac Stegmann Nature Reserve, 1 713 m, *Mogg 35478* (PRE); Potchefstroom (-CA), *Louw 776* (PRE); Potchefstroom distr., Laerberg, *Theron 828* (PRE).

——2628 (Johannesburg): Johannesburg (-AA), *Moss 8538* (BOL), *Leendertz 6190* (PRE); Modderfontein, *Conrath 353* (K); Germiston, *Rogers 12107* (PRE); Heidelberg (-AD), *Leendertz 7727* (PRE); Lagersport nr. Heidelberg, *Crosser 1567* (PRE); Farm "Wetter" (Schoongezicht 64), ca. 1 580–1 760 m (-AD?), *Mogg 24167* (SRGH); Suikerbosrand, ca. 1 680 m (-AD, -CA), *Bredenkamp 990* (PRE), *Repton 5358* (PRE); 18 m E of Vereeniging, Visgat, ca. 1 520 m (-CA), *Codd 4465* (PRE).

——2629 (Bethal): Bethal (-AD), *Leendertz 9381* (PRE); Standerton (-CD), *Leendertz 11004* (PRE).

——2630 (Carolina): Carolina (-AA), *Rademacher 7276* (PRE); Spitskop (-CB), *Pott 15162* (PRE); ca. 21 m E of Amersfoort on Piet Retief rd. (-CC), *Puff 770103–1/1* (NU, WU); Carolina distr., Farm "Bergendal", ca. 1 640 m, *Galpin s.n.* sub PRE *12498* (BOL, PRE).

——2725 (Bloemhof): Leeufontein, 10 km W of Wolmaranstad (-BB), *Van Wyk 729* (PRE); Boskuil, ca. 1 300 m (-BD), *Sutton 238* (PRE).

——2729 (Volksrust): Volksrust (-BD), *Jenkins 9315* (PRE).

——2730 (Vryheid): Farm "Oshoek" nr. Wakkerstroom, ca. 2 000 m (-AC), *Devenish 440* (PRE), *1238* (K, NH). *Puff 770102–1/1* (NU, WU).

Uncertain localities: Kolonie Plaats, *Burtt Davy 9096* (PRE); P.P. Rust, *Rogers 2376* (PRE). ? Potgietersr

ORANGE FREE STATE—2727 (Kroonstad): Heilbron, banks of Vaal R., ca. 1 450 m (-BD), *Brandmüller 140* (NBG, PRE); Kroonstad distr., nr. Vals R., ca. 1 370 m (-CB), *Pont 427* (PRE); Kroonstad distr., Farm "Rondavel Noord 1475", ca. 1 340 m, *Scheepers 1718* (PRE).

——2728 (Frankfort): Senekal distr., Doornkop, *Goosens 641* (PRE; ± atypical).

——2825 (Boshof): Krugersdrift Nature Reserve, ca. 1 380 m (-DD), *Müller 1334* (PRE).

——2828 (Bethlehem): embankment of Bethlehem-Kroonstad railway line (Bethlehem distr.), ca. 1 500 m (-AA), *Potgieter 40* (PRE: ± atypical); nr. Bethlehem, ca. 1 500 m (-AB), *Flanagan 2089* (PRE), *Bolus 8172* (BOL); 6 m from Bethlehem on Kestell rd., ca. 1 700 m, *Werger 25* (PRE); Arran nr. Skulpspruit, ca. 1 700 m, *Werger 105* (PRE, SRGH); Clarens ~~(-CB), *Van Hoepen 18186*~~ =with (PRE); Witsieshoek (-DB), *Junod 17478* (PRE).

——2829 (Harrismith): Drakensberg and Eastern O.F.S. Botanic Gardens, ca. 1 700 m (-AC), *Jacobsz 1030* (PRE), *2076* (NBG), *Van der Zeyde s.n.* sub PRE *41947* (NBG, PRE, SRGH); Harrismith, *Sankey 82* (K); Swinburne, Rensburgskop (-AD), *Jacobsz 178* (PRE).

——2925 (Jagersfontein): Fauresmith distr., Groenvlei, *Verdoorn 1050* (PRE).

——2926 (Bloemfontein): Bloemfontein, ca. 1 380 m (-AA), *Potts 433* (BOL), *1091* (PRE), *Hanekom 831* (PRE);—, O.F.S. Botanic Garden, *Müller 412* (NBG); Wintervalley N of Bloemfontein, *Müller 421* (PRE); Thaba Nchu Mtn. (-BB), *Roberts 2346* (PRE; ± atypical).

——3027 (Lady Grey): Zastron (-AC), *Maree 92* (PRE, ± atypical).

Uncertain or inexact localities: between Bloemfontein and Brandfort, *Acocks 8264* (S); Kafferfontein, *Kies 316* (PRE).

NATAL—2729 (Volksrust): Newcastle Distr., Farm "Boscobello" (-BD), *Jenkins 12468* (PRE).

——2829 (Harrismith: Van Reenen, ca. 1 680 m (-AD), *Medley Wood 12110* (BOL, NU, SAM), *Franks* sub Medley Wood *12110* (NH), *Bews 228* (NU); Van Reenen pass, ca. 1 500 m, *Medley Wood 945* (E); nr. Winterton (-CC), *King 1* (PRE); Farm "Brakfontein" nr. Frere, ca. 1 070 m (-DD), *Acocks 10843* (NH).

——2830 (Dundee): Vant's Drift, ca. 1 070 m (-BA), *Codd 2388* (PRE).

——2929 (Underberg): summit plateau of Drakensberg nr. Giant's Castle pass, ca. 3 000 m (-AD), *Wright 1152* (E, NU, PRE; ± atypical); Estcourt, ca. 1 200 m (-BB), *West 1829* (NH); Mooi River (-BC), *Johnston 146* (E), *Medley Wood 3562* (K, NH, SAM); —, banks of Mooi R. nr. Lake Hotel (-BC), *Johnston 707* (E); hills nr. Mooi River, ca. 1 220 m, *Medley Wood 676* (E), *s.n.* (GRA); Meteor Ridge, ca. 1 450 m, *Mogg 3326* (PRE), *8087* (PRE); Kamberg Nature Reserve, Stillerust Vlei, *Puff 761218–1/1* (WU), *–2/1* (WU), *–1/3* (WU); Farm "Game Pass" adjacent to Kamberg Nature Reserve, ca. 1 800 m, *Gordon-Gray 102* (NU); Farm "Allandale" adjacent to Kamberg Nature Reserve, ca. 1 850 m, *Puff 761220–2/3* (NU, WU; ± atypical), *–3/1* (WU); Kamberg (-BD), *Puff 761219–1/2* (NU, WU) *–2/1* (WU), *–3/2* (NU, WU); Drakensberg Gardens (-CC), *Lawson 978* (NH), *1000* (NH; ± atypical); —, above Forester's house, ca. 2 000 m (-CC), *Puff 761226–1/1* (WU); nr. Bushmen's Nek Police Post, *Hilliard & Burtt 7989* (E, K, NU, S); Thamathu pass, ca. 2 300 m, *Hilliard & Burtt 8947* (NU; ± atypical); Coleford Nature Reserve (-CD), *Sidey 3922* (PRE; ± atypical); Mpendhle, Farm "Tillietudlem", ca. 1 550 m (-DB), *Huntley 107* (NH, NU). Polela distr., "Glenariff", ca. 1 500 m, *Rennie 658* (NU; ± atypical).

——2930 (Pietermaritzburg): Weston (-AA), *Fisher 436* (NH, NU); Rietvlei, Greenwich Farm (-AB), *Fry 2770* (K, PRE); nr. Pietermaritzburg (-CB), *Wilms 2022* (K).

——3029 (Kokstad): Weza, Ingeli slopes (-DA), *Strey 6281* (NH; ± atypical).

Uncertain, inexact or doubtful localities: "Natal & Zululand", "Port Natal", *Gerrard 1340* (K), *Gerrard & Mc' Ken 1340* (S); Movelo (?Rovelo) Hills, ca. 2 100 m, *Sutherland s.n.* (K); Pietermaritzburg-Drakensberg, *Wahlberg s.n.* (S).

LESOTHO—2828 (Bethlehem): Leribe (-CC), *Dieterlen 40* (K, P, PRE); Ox Bow Camp, ca. 2 600 m (-DC), *Lubke 250* (PRE).

——2927 (Maseru): Mamathes, ca. 1 700 m (-BB), *Jacot Guillarmod 89* (PRE); Monethe's, ca. 1 700 m, *Jacot Guillarmod 1918* (PRE); Tebetebeng Mill, ca. 1 500 m, *Jacot Guillarmod 357* (PRE); Roma, ca. 1 700 m (-BC), *Ruch 2151* (PRE); Thabana-li-Mele nr. Roma, ca. 2 600 m, *Williamson 340* (K); Mafeteng, ca. 1 700 m (-CC), *Watt & Brandwyk 1924* (PRE); Thaba Tsoeu, ca. 1 700 m (-CD), *Page s.n.* sub BOL *16796* (BOL); Morija (-DA), *Dieterlen 1145* (PRE); between Makhaleng and Nyakasoba, ca. 2 300 m (-DA, -DB), *Jacot Guillarmod 5776* (PRE).

——2928 (Marakabei): nr. Blue Mountain Pass, ca. 1 900 m (-AC), *Williamson 506* (K); Mamalapi, ca. 2 750 m, *Compton 21349* (NBG); Maletsunyane Falls, ca. 2 100 m (-CC), *Staples 173* (PRE).

——2929 (Underberg): Ndumeni Dome and Cleft Peak, ca. 3 000 m (-AA), *Killick 2322* (PRE, SRGH); Mokhotlong, ca. 2 400 m (-AC), *Jacot Guillarmod 1162* (PRE), *Liebenberg 5802* (PRE).

——3028 (Matatiele): Lehaha-la-Sekhonyana, ca. 2 850 m (-AB), *Jacot Guillarmod 183* (PRE).

Uncertain localities: Maseru distr., Ha Khotso, *Songca 23* (PRE); Quthing distr., Mphaki, ca. 2 300 m, *Archibald 520* (GRA); "Lesotho", ca. 2 200 m, ~~*Ruch 1615* (PRE)~~.

CAPE—2824 (Kimberley): Warrenton (-BB), *Adams 176* (BOL; very atypical).

——2923 (Douglas): St. Clair (-BB), *Orpen 79* (NBG); on Vaal R. at confluence of Orange R., *Burchell 1729* (K).

——3026 (Aliwal North): ca. 3,5 m NW of Ontspringen Station, ca. 1 400 m (-CC), *Acocks 13524* (PRE); Burghersdorp, ca. 1 500 m (-CD), *Flanagan 1537* (BOL, PRE; ± atypical), *Guthrie 4205* (NBG; ± atypical), *Pocock 10810* (PRE; ± atypical).

——3027 (Lady Grey): Dulcie's Nek (-AD), *Marais 1344* (PRE, SRGH).

——3028 (Matatiele): Drakensberg, Tsatsana (Satsanna) Peak, ca. 2 850 m (-AC), *Galpin 6652* (BOL, K, PRE; atypical); 20 m W of Mount Fletcher, ca. 1 830 m (-CC), *Story 500* (PRE).

——3029 (Kokstad): St. Bernards (-AA), *Barker 8017* (NBG; ± atypical); Newmarket (-AD), *Krook 2699* (W; ± atypical); Kokstad, ca. 1 520 m (-CB), *Coleman 317* (NH), *Mogg 5051* (PRE; ± atypical), *Goossens 173* (PRE; ±

atypical); around Kokstad, ca. 1 520 m, *Tyson 1819* (BOL, K, SAM; atypical), *1991* (BOL, K, PRE, SAM; atypical); nr. Mt. Ayliff, on the Umzimhlowa R. (= Mzimhlava), 1 500 m (-CD), *Schlechter 6551* (S, W; ± atypical).

——3124 (Hanover): Noupoort (-BB), *Rogers 17322* (K).

——3125 (Steynsburg): Middelburg (-AC), *Theron 203* (PRE).

——3126 (Queenstown): Jamestown, ca. 1 830 m (-BB), *Gerstner 261* (PRE); Berry Reservoir E of Queenstown (-DD), *Hilner 339* (GRA, PRE; appr. var. *wittbergense*).

——3128 (Umtata): Umtata, nr. Umtata R., ca. 730 m (-DB), *Pegler 1602* (K; ± atypical); between Maclear and Umtata, Cherikwe Mtn., ca. 1 200 m, *Flanagan 2646* (PRE, SAM; ± atypical), *Bolus s.n.* (BOL; ± atypical).

——3226 (Fort Beaufort): Katberg, ca. 1 830 m (-DA), *Schonland 4290* (GRA), *Sole 408* (GRA). Intermediate betw vars.

——3227 (Stutterheim): Hogsback (-CA), *Rattray 433* (PRE); along the Kei R. nr. Komga, ca. 460 m (-DB), *Flanagan 1351* (BOL, NBG, NU, SAM); King William's Town distr., Mount Coke, ca. 600 m, *Sim 19610* (NU, PRE).

——3326 (Grahamstown): Grahamstown (-BC), *Glass 831* (NBG).

Uncertain or inexact localities: Griqualand West, on the Riet R., 1 100 m, *Marloth 906* (PRE); Griqualand East, Vaalbank, *Haygarth s.n.* (E, as *Wood 4217* in K; ± atypical); Grootfontein, *Gilli 10* (GRA).

COLLECTIONS

1? Drège 7674? (see pp. 236 & 7)

ssp. *garipense* var. *wittbergense*

TRANSVAAL—2528 (Pretoria): Derdepoort (-CB), *Leendertz 357* (PRE; ± atypical).

——2628 (Johannesburg): Suikerbosrand, Kafferskraal, ca. 1 600 m (-CA), *Bredenkamp 86* (PRE).

Uncertain locality: Breginsel, *Burtt Davy 1016* (PRE).

ORANGE FREE STATE—2828 (Bethlehem): Kransfontein, ca. 1 680m (-BA), *Hart 64* (NU).

NATAL—2929 (Underberg): Kamberg Nature Reserve, Stillerust Vlei (-BC), *Hilliard & Burtt 8729* (E, K, MO, NU, PRE), *Puff 761218–1/3* (NU, WU); Farm "Allandale", adjacent to Kamberg Nature Reserve, ca. 1 900–2 000 m, *Puff 761220–4/1* (WU); Kamberg (-BD), *Wright 2085* (NU; ± atypical), *Puff 761219–1/2* (NU, WU), *–2/1* (NU, WU), *–6/1* (WU; ± atypical); Highmoor Forest Station, ca. 2 070 m (-BD), *Killick & Vahrmeyer 3633* (NH); valley of Umzimkulu R. above Drakensberg Garden Hotel, ca. 1 680 m (-CC), *Hilliard & Burtt 7736* (E, K, MO, NU, PRE, S; ± atypical); Bushman's Nek, Thamathu pass, ca. 2 300 m, *Hillard & Burtt 8946* (NU; appr. var. *garipense*); Coleford Nature Reserve, "Sunnyside Cottage" (-CD), *Puff 761225–2/2* (WU, ± atypical); —, on the banks of the N'gwangwane R., *Puff 761227–1/1* (NU, WU).

LESOTHO—2828 (Bethlehem): Leribe, ca. 1 500–1 800 m (-CC), *Dieterlen 40* (SAM). Pt

CAPE—3027 (Lady Grey): Majuba Nek nr. Sterkspruit (-CB), *Hepburn 148* (GRA); "Cis-Garipinia", on the Garip (= Oranje), between Kraai R. and Witbergen, ca. 1 500–1 800 m (-DA?), *Zeyher "118:12"* (S); Wittebergen (Witberge), Ben MacDhui, ca. 2 800–3 000 m (-DB), *Galpin 6651* (BOL, K, PRE).

——3126 (Queenstown): Broughton nr. Molteno, ca. 1 930 m (-AD), *Flanagan 1586* (S, SAM); Penhoek pass (-BC), *Barker 2200* (NBG); Queenstown, Hangklip Mtn., ca. 2 000 m (-DD), *Roberts 2024* (PRE), —, ca. 1 780 m, *Galpin 1783* (PRE; appr. var. *garipense*). ← PRE = garipense

——3225 (Somerset East): Cradock distr., *Cooper 548* (BOL, E, K, W).

——3226 (Fort Beaufort): Groot Winterberg, S of Tarkastad, Farm "Fairfield", ca. 1 680 m (-AD), *Comins 787* (PRE).

——3228 (Butterworth): Kotana (-AA), *Lussem 57* (NBG; ± atypical).

3. **G. monticolum** Sond. in Fl. Cap. **3:** 36 (1865). Type: South Africa, Cape Prov., mountains near Cape Town, *Ecklon 84* (S!; WU: photo!).

Perennial with a ± woody rootstock. Stems ascending to erect, ca. 0,3–1,2 m long, usually with many lateral branches; ca. 2,5 mm in diam., densely covered with short, spreading hairs, distinctly 4-angled, except ± terete near the base; sometimes purplish. Longest internodes 12–17(25) mm. Middle cauline leaves in whorls of (6–)8–10, 1-nerved, 5–8(12) × 0,6–0,8(1) mm, linear, with a long whitish, sometimes upturned mucro at the apex, often apparently terete due to the strongly reflexed margins; upper surface, midrib beneath and margins densely covered with ± long, white spreading hairs. Synflorescences ± cylindrical, paracladia relatively few-flowered, flowers arranged in groups of (5)4–1, ultimate branches with (5)3–1(0) minute, linear hairy bracts; peduncles 0,8–1,5 mm, ± thickish, hairy, pedicels 0,8–1,5(2) mm, filiform, glabrous, divaricate after anthesis. Flowers 4-merous; corolla (1,5)1,7–2(2,3) mm in diam., rotate, colour unknown; lobes longer than wide, acuminate; stamina ca. ¼ of lobe length, anthers roundish; styles short, ca. half or less fused. Young gynoeceum glabrous, ± granulate; mature fruits not seen.

Habitat: On mountain slopes, scrambling among bushes.

Flowering Period: October to November.

Distribution (map, Fig. 15): Endemic to the Western Cape.

Critical Remarks: *G. monticolum* is undoubtedly a very close ally of *G. capense* (ssp. *namaquense* and ssp. *capense*). The few collections available clearly differ from the above two subspecies of *G. capense* by their indumentum (± villous), their somewhat fewer-flowered paracladia and smaller flowers and their usually narrower leaves, but are difficult to separate otherwise (partly because *G. capense* is a rather variable species producing a wide range of "forms"). *G. capense* ssp. *namaquense* is probably closest to *G. monticolum*, and grows in the same general

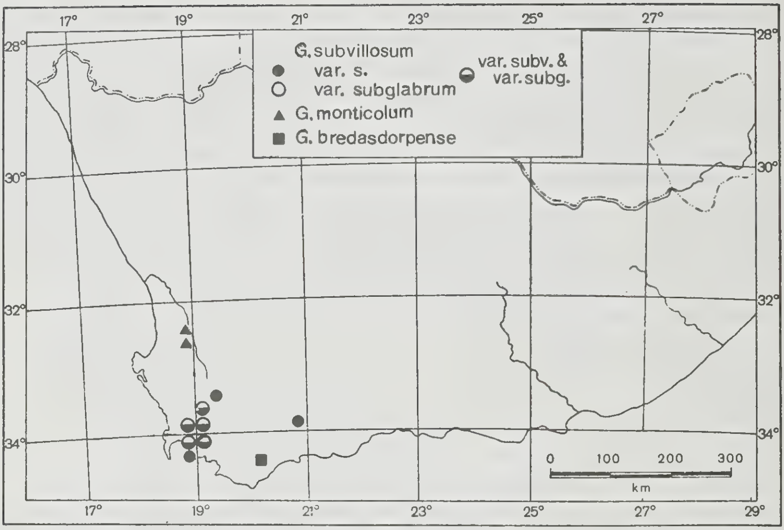

Fig. 15.
Distribution of *G. subvillosum* var. *subvillosum* and var. *subglabrum*, *G. monticolum*, and *G. bredasdorpense*.

area. Much more material of both is needed to see if the characteristics used here to separate them really hold. The status of *G. monticolum* might then need to be reconsidered.

COLLECTIONS

CAPE—3218 (Clanwilliam): between Witte Els Kloof and Lamberts Hoek Berg (-BD), *Pillans 9083* (BOL, PRE); slopes above "Pickinier's Pass" (Piekenierskloofpas) (-DB), *Pearson 5177* (BOL, K).

Uncertain locality: "Mountains near Cape Town", *Ecklon 84* (S).

4. **G. bredasdorpense** Puff, sp. nov.

Herba perennis, decumbens vel suberecta; caules ca. 150–250 mm longi, ramosissimi, teretiusculi basi, sursum tetragoni, dense scabriosi (saltem rami juniores), internodiis 1–5(6) mm longis. Folia et stipulae foliaceae 6-natim verticillata, sessisila; lamina plus minusve ovato-lanceolata, 1,5–2,5 mm longa, 0,7–1,2 mm lata, apice mucrone albida, nitida, glabra, margine plus minusve reflexa. Cymae axillares, 3(–1)-florae; pedunculi 0,5–1 mm longi, glabri, pedicellis 0,8–2 mm longis, filiformibus, glabris, postfloraliter divaricatis. Corolla rotata, glabra, 1,5–2 mm diam., colore ignoto; lobi 4, plus minusve triangulares, breviter acuminati.

Ovarium glabrum, plus minusve granulatum, subglobosum. Fructus maturus non visus.

Affinis *G. capensi* Thunb. sed foliis brevioribus et internodiis vrevissimis et cymis 3(–1)-floribus axillaribus valde differt.

Perennial. Stems decumbent or suberect, ca. 150–250 mm long, with many lateral branches; 2–2,5 mm in diam. and terete at the base, ca. 0,5–1 mm in diam. and distinctly 4-angled in the mid-stem region; at least younger parts densely scabrous with short, straight whitish hairs. Longest internodes 1–5(6) mm. Middle cauline leaves in whorls of 6, 1-nerved, 1,5–2,5 × 0,7–1,2 mm, ± ovate-lanceolate, with a ± long, whitish mucro at the apex, glabrous, shiny, margin ± reflexed. Synflorescences very reduced, paracladia 3–1-flowered; peduncles 0,5–1 mm, glabrous, pedicels 0,8–2 mm, with 4(–1) leaf-like bracts, filiform, glabrous, divaricate after anthesis. Flowers 4-merous; corolla 1,5–2 mm in diam., rotate, glabrous, colour unknown; lobes much longer than wide, ± triangular, shortly acuminate; stamina ca. half as long as the lobes, filaments filiform, anthers ± ovate; styles ca. ½ fused. Gynoceum glabrous, ± granulate; mature fruit not seen.

Type: South Africa, Cape Prov., Bredasdorp distr., 2 m S of Wydgelegen Post office [= 3420 (Bredasdorp) -AD], *Acocks 23175* (PRE!; WU: photo!)

Habitat: "In Kalk Coastal Fynbos" (notes from the type collection).

Flowering Period: November to December.

Distribution (map, Fig. 15): Endemic to the limestone formations of the Bredasdorp district.

Critical Remarks: *G. bredasdorpense* seems to be a close ally of *G. capense* (ssp. *capense*), but clearly differs in having very short internodes (frequently shorter than the minute leaves), short, ovate-lanceolate leaves (vs. long, linear in *G. capense*) and highly reduced inflorescences with leaf-like bracts and smaller flowers.

G. bredasdorpense is known only from the type collection, and only the future can tell whether the species is indeed strictly confined to the highly interesting limestone area in the Bredasdorp district[1] which is known to be extremely rich in endemics (Rourke, personal communication, thinks that it would be possible to list well over 100. Exact data, however, are not available).

5. **G. amatymbicum** Eckl. & Zeyh., Enum. Pl. Afr. Austr.: 370 (1836). Type: South Africa, "Tambukiland" (= Eastern Cape Province), on the right side of the "Keyrivier" (Kei R.), *Ecklon & Zeyher 2328* (GOET!, S!, SAM!; WU: photo!).

Perennial with ± extensive rhizomes. Stems weak, caespitose, ca. 150–300 mm long, with many, often short lateral branches; ± filiform, less than 1 mm in diam., ± 4-angled, with ± long white spreading hairs or glabrous. Longest internodes 8–10(15) mm. Middle cauline leaves in whorls of 6, 1-nerved, (2)3–5(6) × (0,7)0,8–1 mm, linear-lanceolate to lanceolate, ± acuminate at the apex; with ± long white spreading hairs on upper and lower surface or at least on margins and midrib above and beneath. Synflorescences extremely reduced; paracladia only 1-flowered, peduncles/pedicels (0,5)1(2) mm, ± thickish, hairy or glabrous, ± arcuate in fruit. Flowers 4-merous; corolla ca. 1,5 mm in diam., ± rotate, hairy outside, whitish; lobes longer than wide, acute; stamina very short. Fruits dry, with long ± straight hairs or subglabrous; mericarps ± reniform, each ca. 1–1,5 mm wide.

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[1] Acocks (1975) suggests that the "Fynbos" of this area should be considered a distinct veld type of its own ("Kalk Coastal Fynbos").

Habitat: ''In *Acacia* fields'' (Ecklon & Zeyher, 1836).

Flowering Period: December.

Distribution (map, Fig. 19): Endemic to the Eastern Cape Province.

Critical Remarks: Although known from two collections only, *G. amatymbicum* is a ''good'' and well marked species. It is separated from weak forms of *G. capense* (presumably its closest ally) by its solitary flowers in the axils of main-stem whorls or at the end of short lateral branches; from the remaining Southern African taxa with highly reduced synflorescences (*G. spurium* ssp. *africanum, G. chloroionanthum, G. bredasdorpense*) by its weak stems, minute leaves, very short peduncles/pedicels and its indumentum.

COLLECTIONS

CAPE—3226 (Fort Beaufort): ''Tambukiland'', on the right side of the ''Keyrivier'' [= between Windvogelberg and Swartkey: Drège (1847a: 584)] (-BB), *Ecklon & Zeyher 2328* (GOET, S, SAM);—, Hogsback Mtn., Gaikas Kop (-DB), *Rattray 343* (BOL).

6. **G. bussei** K. Schum. & K. Krause in Bot. Jahrb. **39:** 571 (1907). Type: Tanzania, Songea distr., Ngaka (Mgaka) valley, *Busse 941* (B, EA; K: photo!).
G. stenophyllum Bak. var. *flavoviride* Utzschn. & Merxm. in Transact. Rhod. Sc. Ass. **43:** 57 (1951). Type: Rhodesia: Marandellas distr., *Dehn 719A* (SRGH!).
G. stenophyllum auct., non Bak.

Perennial with somewhat woody rootstocks. Stems erect or semi-erect, (200) 300–600 mm long, with usually few, ± short lateral branches; 1,5–2(2,5) mm in diam., with 4 distinct, often whitish angles with short, ± spreading hairs or glabrous; nodes usually densely hairy. Longest internodes (15)25–40(55) mm. Middle cauline leaves in whorls of 6–10, 1-nerved, (18)20–30 × 0,5–1(1,5) mm, linear, often apparently terete due to the strongly reflexed margins, with a distinct brownish acumen at the apex; upper and lower surface with short, ± spreading hairs, glabrous or with minute, forwardly directed prickles above. Synflorescences

± narrowly cylindrical, paracladia ± many-flowered and dense, ultimate branches with (0)1–4 minute bracts; pedicels 1–1,5 mm, ± filiform, glabrous, strongly divaricate in fruit. Flowers slightly protandrous, 4-merous; corolla 2–2,5(3) mm in diam., rotate, glabrous, yellow, pale yellow or greenish-yellow; lobes longer than wide, ± acuminate; stamina ca. half as long as the lobes, filaments ± filiform, anthers ± elliptic; styles long, ca. ½ fused. Fruits dry, glabrous, ± granulated; mericarps subglobose, each 1,5–2 mm wide.

Two varieties recognized:

6a. var. **bussei**

G. stenophyllum Bak. var. *flavoviride* Utzschn. & Merxm. in Transact. Rhod. Sc. Ass. **43:** 57 (1951). Type: Rhodesia: Marandellas distr., *Dehn 719A* (SRGH!).

G. stenophyllum auct., non Bak.

Stems (at least on the angles) and leaves (mainly lower surface) covered with short, ± spreading white hairs.

Habitat: In grassland (often *Themeda*-veld), in open *Brachystegia* woodland; sometimes on rocky outcrops and streamsides. Ca. 1 200–1 800 m.

Flowering Period: October to February (March, April, May).

Distribution (maps, Figs. 16, 17): From Tanzania and Malawi to Rhodesia.

In References: 1953? / [illegible]

6b. var. **glabrum** Brenan in Mem. N.Y. Bot. Gard. **8:** 456 (1954). Type: Tanzania, Mbulu distr., Ufiome Mtn., *Burtt 2728* (EA, K!; NU, WU: photos!).

Stems and leaves without short, ± spreading white hairs, or plants glabrous altogether. Nodes may occasionally be ± hairy.

Habitat and Flowering Period: As in var. *bussei*.

Distribution (maps, Figs. 16, 17): From Tanzania, East Zambia, Malawi and Moçambique to Rhodesia.

Critical Remarks: *G. bussei* has consistently been confused with *G. stenophyllum* Bak., a species not at all closely allied to *G. bussei* but belonging to *Galium* sect. *Aparinoides* (Puff, 1974) and restricted to Tropical Africa. For a discussion and clarification of this problem refer to Brenan (1953). 1954?

On the basis of synflorescence structure, *G. bussei* is subdivided into two groups of varieties (dense, many-flowered: var. *bussei*, var. *glabrum* Brenan; lax, diffuse, sometimes few-flowered: var. *strictius* Brenan, var. *glabrostrictius* Brenan). Only the first group is represented in Rhodesia (the other is restricted to Malawi, Tanzania, Zambia and Zaire), and, at least as far as Rhodesian material is concerned, the further separation into a hairy (var. *bussei*) and glabrous form (var. *glabrum*) appears to be worth following [Verdcourt (1976:400) considers the present subdivision somewhat unreliable, but his investigations were based on tropical material only]. Glabrous and hairy forms may sometimes be found together [cf. Miller 5639 (SRGH), for example].

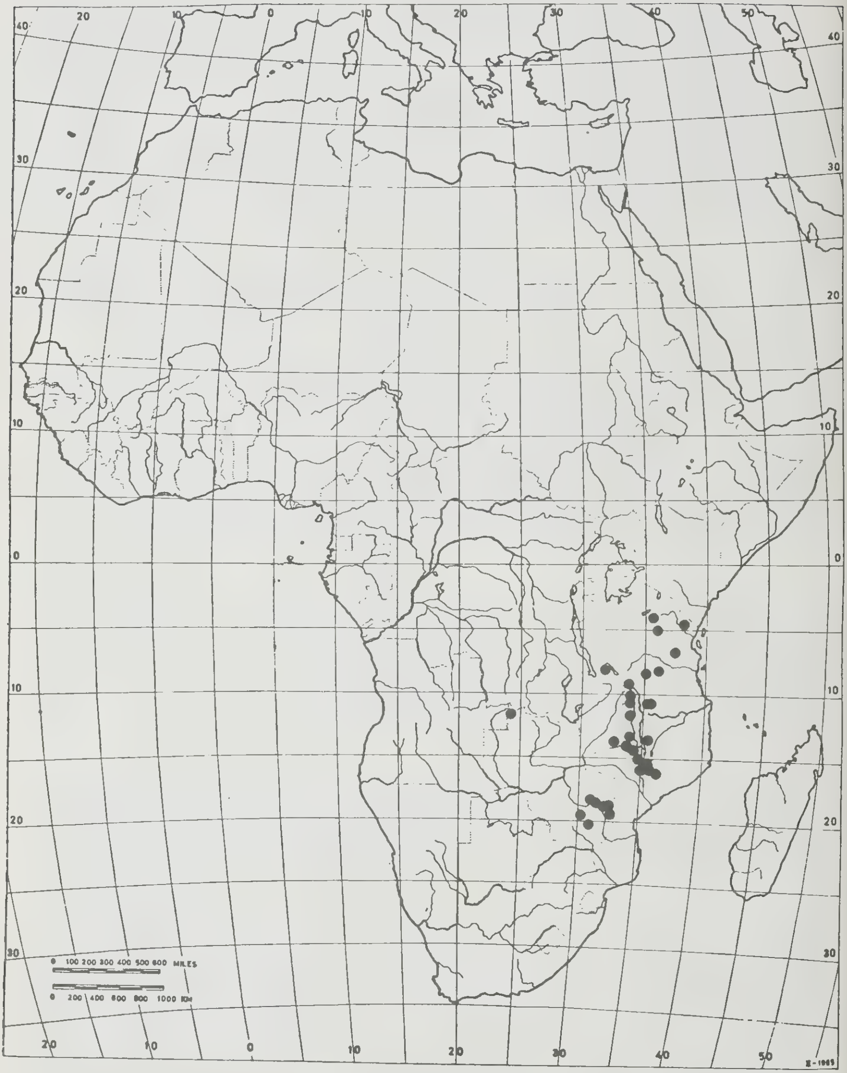

FIG. 16.
Distribution of *G. bussei*
(var. *bussei*, var. *glabrum*, var. *strictius*, and var. *glabrostrictius*).

COLLECTIONS

var. *bussei*

RHODESIA—1731: Ruwa distr., Tanglewood Farm, ca. 1 500 m (-CD), *Miller 5639* (SRGH), *7558* (K, LISC, P, SRGH).

——1831: Marandellas dist., main road near Eagle's Nest, ca. 1 500 m (-BA), *Davies 2969* (SRGH); —, *Dehn 719A* (SRGH).

——1832: Inyanga distr., Inyanga, ca. 1 800 m (-BC), *Boughey 465* (SRGH); —, near village Inyanga Down, *Norlindh & Weimarck 4677* (PRE, SRGH); —, Troutbeck, *Gailey 206* (SRGH); —, way to Slave Pits, *Grosvenor 18* (SRGH); —, Inyanga Falls, ca. 1 600 m, *Jacobsen 3709* (SRGH); Rusape distr., Valhalla (-CA), *Dehn s.n.* sub SRGH *41100* (SRGH); Umtali distr., Watsomba, Kukuransia Irrig. Farm (-DA), *Biegel 1671* (SRGH);—, Umtali Commonage (-DC), *Chase 205* (SRGH).

——1932: Melsetter distr., (-D), *Williams 126* (SRGH).

Uncertain localities Makoni distr., Forest Hill, ca. 1 500 m, *Eyles 723* (SAM, SRGH); —, near Maidstone, *Norlindh & Weimarck 4065* (SRGH).

COLLECTIONS

var. *glabrum*

RHODESIA—1730/1731: Salisbury distr., Chindamore Reserve Gomakarira, ca. 1 500 m, *Wild 3752* (LISC, PRE, SRGH).

——1731: Ruwa distr., Tanglewood Farm, ca. 1 500 m (-CD), *Miller 5639* (SRGH); —, Ruwa, Rockfall Farm, ca. 1 500 m, *Miller 8083* (K, LISC, PRE, SRGH).

——1832: Inyanga distr., near Inyanga (-BC), *Fries Norlindh & Weimarck 2445* (SRGH); —, Juliasdals, Pienaar's Farm, *Rutherford-Smith 507* (SRGH); —, near Darmalsay (?spelling), *Whellan 713* (SRGH); —, *Hopkins 8602* (SRGH); Pungwe Hills distr., (-BD), *Hopkins 7156* (PRE, SRGH); Umtali distr., Christmas Pass (-DC), ca. 1 350 m, *Matineau 296* (SRGH), *"Herb. Q.V.M. 7092"* (SRGH); —, Penhalonga, ca. 1 500 m, *Robinson 1857* (SRGH).

——1832: Umtali distr., Umtali Commonage (-DC), *Wild 461* (PRE).

——1832/1932: Umtali distr., Matika's Kloof, *Chase 1905* (SRGH); — Engwa, 1 600 m, *Exell, Mendonça & Wild 3* (LISC, SRGH).

——1929/1930: Selukwe distr., Waterfall Valley, *Duches 2* (LISC, SRGH); —, *Loveridge 565* (SRGH).

——1930: Selukwe distr., Ferny Creek (-CA), *Biegel 1495* (SRGH).

——1932: Umtali distr., Himalaya Mtn., Dickers Farm (-BD), *Dale SKF411* (SRGH); Melsetter distr., 15 m S of Melsetter, ca. 1 800 m (-DD), *Fisher 1261*

(NU, PRE, SRGH); —, Chimanimani National Park, upper Bundi, west tributary, ca. 1 500 m *Phipps 432* (PRE, SRGH); —, on Haroni R., *Mavi 810* (SRGH); —, ca. 3 m SW of Melsetter, on new Umtali rd., ca. 1 400 m, *Drummond 5030* (SRGH); —, Gilbury, ca. 1 000 m (-D), *Wild 3589* (LISC, SRGH); —, *Williams 126* (SRGH).

——2030: Belingwe distr., Bukwa Mtn., ca. 1 300 m, (-CB), *Pope, Siegel & Simon* Mtunumashava Hill (-BB), *Grosvenor 511* (SRGH).

——2030: Fort Victoria distr., Kyle National Park Game Reserve, near base of Mtunumashava Hill (-BB), *Grosvenor 511* (SRGH).

7. **G. scabrelloides** Puff, sp. nov.

Herba perennis, scandens vel decumbens, caudice parum lignoso; caules (0,3)0,5–1,0(1,2) m longi, (1)1,5–2,5(3) mm diam., tetragoni, pilis albis patentibus plus minusve dense obtecti, internodiis (25)30–65(75) mm longis. Folia et stipulae foliaceae (7)8–10-natim verticillata, basi plus minusve cuneata; lamina linearis usque anguste lineari-lanceolata vel oblanceolata, (12)15–20(22) mm longa, (0,6)0,8–4(5) mm lata, apice mucrone albida, margine reflexa et grosse retrorso-aculeata, ceterum pilis albis patentibus supra et infra obtecta, rarius solum nervi pilis muniti. Synflorescentiae multiflorae; pedunculi 2–3 mm longi, pedicellis 1–2,5(3) mm longis, plus minusve filiformibus, pilis albis obtectis, postfloraliter valde divaricatis. Corolla 1,8–3,5(4) mm diam., rotata, vulgo extus pilis albis (sparse) obtecta, lutea vel ochroleuca vel luteo-viridis vel viridula; lobi 4, plus minusve ovati, acuti. Fructus subglobosus usque leviter reniformis, pilis albis strictic patentibus obtectus, rarissime glaber; cocci (0,7)0,8–1(1,2) mm diam.

Perennial with a somewhat woody rootstock. Stems climbing or decumbent, (0,3)0,5–1,0(1,2) m long, often with ± many lateral branches; (1)1,5–2,5(3) mm in diam., with white spreading hairs at least on the 4 distinct, often whitish angles. Longest internodes (25)30–65(75) mm. Middle cauline leaves in whorls of (7)8–10, 1-nerved, (12)15–20(22) × (0,6)0,8–4(5) mm, linear to linear-lanceolate or oblanceolate, with a whitish mucro at the apex and cuneate at the base; both surfaces, or at least midrib with white, ± straight spreading hairs, the (strongly) reflexed margins with closely set, coarse reversed prickles. Synflorescences broadly to narrowly pyramidal, paracladia many-flowered, ultimate branches with 3–1 tiny, linear to lanceolate bracts; peduncles 2–3 mm, pedicels 1–2,5(3) mm, ± filiform, hairy, strongly divaricate in fruit. Flowers slightly protandrous, 4-merous; corolla 1,8–3,5(4) mm in diam., rotate, usually somewhat hairy outside, bright yellow, creamy-yellow, greenish-yellow or greenish; lobes much longer than wide, ± ovate, acute; stamina a little less than half as long as the lobes, filaments ± filiform, anthers elliptic; styles fused to the middle. Fruits dry, (densely) hairy with straight, white spreading hairs, rarely glabrous; mericarps subglobose to slightly reniform, each (0,7)0,8–1(1,2) mm wide; often only one mericarp developed.

Type: South Africa, Natal, Cathedral Peak Forest Reserve, Catchment 9, ca. 2 000–2 200 m, *Puff 760314–1/2* (WU).

Chromosome Number: n = 11, 2n = 22.

Habitat: In forest margin vegetation, dense *Leucosidea* and/or *Buddleia* scrub, amongs bushes along stream banks, in vleis, or (more rarely) in open grassland. Confined to damp or wet, ± shady locations. Ca. (850)1 300–2 600 m.

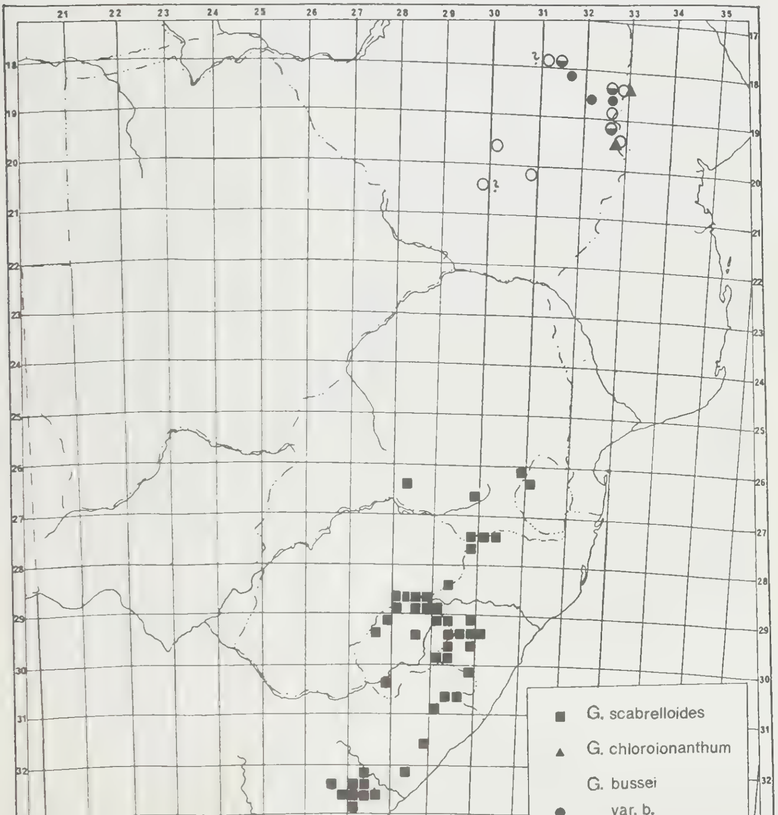

FIG. 17.

Distribution of *G. scabrelloides* (whole range), *G. chloroionanthum* (Southern Africa only), and *G. bussei* var. *bussei* and var. *glabrum* (Southern Africa only).

Flowering Period: December to March.

Distribution (map, Fig. 17): From North West Swaziland through the South East Transvaal, South East Orange Free State, Lesotho, Natal Midlands and Uplands, and Transkei southward to the Eastern Cape Province.

Critical Remarks: *G. scabrelloides* shows close affinity to the ± tropical East African *G. scabrellum* but differs in having stems with much longer internodes, longer, often broader leaves, frequently very broadly pyramidal synflorescences with bracts at the ultimate branches, longer peduncles and often larger flowers with acute, but not acuminate corolla lobes. Although the two species are sometimes difficult to distinguish morphologically, species status, in my opinion, appears most appropriate for this southern ''vicariant'' of *G. scabrellum*, particularly in view of the generally narrow species concepts adopted here.

G. scabrelloides displays considerable variability in its growth form (branching pattern) and leaf size and shape, which, to a certain extent, seems to be environment-dependent. Very narrow-leaved, weakish forms were often mistaken for ''*G. wittbergense*'' (= *G. capense* ssp. *garipense* var. *wittbergense*). They are, however, easily distinguished from the latter by the indumentum (particularly of the gynoceum: straight hairs in *G. scabrelloides*; short, curled hairs in the *G. capense* complex) and the leaf margins with very closely set reversed prickles.

G. scabrelloides and *G. capense* ssp. *garipense* are frequently found growing in the same area, but usually a clear difference in ecological demands is recognizable: *G. scabrelloides* prefers more sheltered, not open habitats and is frequently found in between much higher growing vegetation. It appears to favour somewhat wetter habitats. It was also observed that *G. scabrelloides* begins flowering much later than *G. capense* ssp. *garipense* when the two taxa were seen in the same area. I have seen no hybrids, but in my opinion it cannot be excluded that introgression takes place between the two taxa.

Occasionally one encounters ± glabrescent forms[1] (subglabrous gynoeceum; leaf surfaces with very few hairs only). Since such forms may even occur within populations whose individuals have a perfectly normal indumentum, they of course deserve no taxonomic recognition.

COLLECTIONS

TRANSVAAL—2628 (Johannesburg): Heidelberg Kloof, ca. 1 500 m (-AD), *Story 1613* (PRE: ± atypical).

——2629 (Bethal): Ermelo (-DB), *Leendertz 7777* (PRE).

——2630 (Carolina): Lochiel (-BB), *Rogers 11478* (PRE).

——2730 (Vryheid): Wakkerstroom, ca. 1 900 m (-AC), *Beeton 232* (SAM); Kastrolnek (-AD), *Fitzsimons & Van Dam 26062* (PRE).

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[1] Listed as ''atypical'' in ''Collections''.

Uncertain locality: Volksrust distr., "Highlands", ca. 1 700 m, *Mogg 7522* (PRE).

ORANGE FREE STATE—2828 (Bethlehem): Farm "Dunelin" nr. Fouriesburg (-CA), *Potts 3087* (NBG, PRE); Farm "Dunblane" nr. Clarens (-CB), *Potts 2984* (PRE); Golden Gate National Park (-DA), *Compton 22520* (NBG), *Roberts 3412* (PRE); —, rd. to Generaalskop, ca. 2 700 m, *Roberts 3114* (PRE; atypical); Witsieshoek (-DB), *Junod 17508* (PRE); Bester's Vlei nr. Witsieshoek, ca. 1 700 m, *Flanagan 1935* (SAM, PRE); Bester's valley, ca. 1 900 m, *Bolus 8170* (BOL); Harrismith distr., *Surit* (?spelling) *115* (PRE). = Smit?

Uncertain locality: Vrede distr., Farm "Tygerkloof" ca. 1 700 m, *Pentz s.n.* sub PRE *42022* (PRE).

SWAZILAND—2631 (Mbabane): hill NW of Mbabane, ca. 1 370 m (-AC), *Dlamini s.n.* (K, NBG, PRE). sub PRE 4198.

NATAL—2729 (Volksrust): Farm "Glen Atholl" nr. Volksrust and Charlestown, ca. 1 800 m (-BD), *Smith 5630* (PRE); farm "Boscobello" (-DB), *Jenkins 25527* (PRE).

——2730 (Vryheid): Groenvlei-Wakkerstroom rd., ca. 3–5 m from Natal/Transvaal border (-AC), *Puff 770101–3/3* (WU).

——2828 (Bethlehem): Royal Natal National Park, Witsieshoek Gate, ca. 2 200 m (-DD), *Hilliard & Burtt 8593* (E, K, NU); —, Mont-aux-Sources, *Dordge s.n.* sub PRE 41980 (NBG, P, PRE), *Sim s.n.* sub PRE *42019* (NU, PRE); —, Tugela valley, ca. 1 500–1 800 m, *Bayer & Maclean 48* (K, PRE), *Humbert 15020* (P).

——2829 (Harrismith): Van Reenen pass (-AD), *Kuntze s.n.* (K); Umlambonja (= Mhlambonjwa) valley, ca. 1 450 m (-CC), *Schelpe 7243* (BOL), *Rudatis 1576* (E, K, S); Cathedral path, ca. 2 450 m, *Schelpe 107* (NU).

——2929 (Underberg): below Organ Pipes pass, ca. 2 300 m (-AA), *Edwards 1177* (NU); Giant's Castle Game Reserve, ca. 1 500–1 700 m (-AB), *Trauseld 538* (NU, PRE), *Coleman 361* (NH);—, nr. Barnes shelter, *Puff 761221–1/1* (NU, WU);—, Bushman R. below hutted camp, *Puff 761221–4/1* (NU, WU);—, tributary of Bushman R. on path to "Main Cave", *Puff 761221–3/1* (NU, WU);—, Injasuti valley, path to "Battle Cave", *Puff 760516–2/5* (WU); Cathedral Peak Forest Reserve, Forest Research Station, catchment 3, ca. 1 850 m, *Killick 1241* (K, NH, S, SRGH);—, catchment 7, *Puff 760314–8/4* (WU);—, catchment 9, *Puff 760314–1/2* (WU),*–2/2* (WU),*–3/1* (NU, WU),*–4/1* (NU, WU);—, catchment 10, *Puff 761120–2/8* (WU);—, nr. Sebaaieni Cave, tributary of Ndedema, *Puff 761121–3/3* (WU); Giant's Castle, ca. 2 050–2 150 m (-AD), *Symons 14579* (PRE), *Bruyns-Haylett 74* (NU); Bushman's pass, ca. 2 200 m, *West 1667* (PRE); Bushman R. nr. Dalton Bridge (-BB), *Acocks 10045* (NH); 5 m from jct. of S and N branch of Loteni R., ca. 1 550 m (-BC), *Wright 1482* (NU); Farm Allandale, adjacent to Kamberg Nature Reserve, ca. 1 950 m, *Puff 761220–4/1* (NU, WU); summit of Kamberg (-BD), *Puff 761219–4/1* (NU, WU); above Highmoor Dam, ca. 2 000 m, *Nicholson 499* (NH); nr. Bushman's Nek police post (-CC), *Hilliard & Burtt 7986*

(NU); Drakensberg Gardens, above forester's house, ca. 2 000 m, *Puff 761226–1/2* (WU); Coleford Nature Reserve, "Sunnyside Cottage" (-CD), *Puff 761225–1/2* (NU, WU); Mpendhle, ca. 1 520 m (-DB), *Edwards 2518* (NU); summit of Nhlosane Mtn. nr. Dargle, *Puff 761125–3/6* (WU). McClean?

——2930 (Pietermaritzburg): Nottingham Road (-AC), *Maclean 932* (NH).

——3029 (Kokstad): Farm "Lynn Avis", 10 m from Ixopo on Donnybrook rd., ca. 1 300 m (-BB), *Crewe 51* (NH, NU); Zuurberg nr. Weza, Natal/Transkei border (-DA), *Puff 760509–1/1* to–*1/5* (WU), *Hilliard & Burtt 8054* (K, NU, PRE; atypical), *Schlechter 6609* (B, BOL, GRA, PRE).

Uncertain or inexact localities: N Berlin Mission station nr. Hoffenthal, *Medley Wood 3556* (BOL, K, NH, SAM); Mooirivier distr., Warley common, *Mogg 7183* (PRE); Thackleta (?spelling), *Johnston 779* (E); Mohlamba (= Drakensberg?) range, ca. 1 500–1 800 m, *Sutherland s.n.* (K).

LESOTHO—2828 (Bethlehem): Leribe, 1 500–1 800 m (-CC), *Dieterlen 331a* (SAM, PRE); Ox Bow Camp, Tschlangana valley, ca. 2 600 m (-DC), *Jacot Guillarmod 3794* (PRE).

——2927 (Maseru): Mhlatsa's, ca. 2 100 m (-BB), *Jacot Guillarmod 464* (PRE; atypical); Roma, ca. 1 680 m (-BC), *Ruch 1742* (PRE), *1940* (PRE), *Schmitz 337* (PRE).

——2928 (Marakabei): Mountain Road, ca. 2 300 m (-BC), *Jacot Guillarmod 3321* ? (RUH, PRE).

——2929 (Underberg): Sani Pass-Mokhotlong rd., base of Black Mtn. (-CB), *Puff 761209–7/5* (NU, WU).

——3027 (Lady Grey): Liseleng valley (-BD), *Coetzee 522* (PRE; atypical).

No localities given: "Basutoland", *Cooper 2499* (K), *2500* (E, Z), *Schmitz 225* (PRE). ? ± atypical

CAPE—3029 (Kokstad): nr. Kokstad, ca. 1 600 m (-CB), *Tyson 1422* (BOL, PRE), *1626* (SAM, BOL; atypical); nr. Rode, ca. 1 500 m (-CC), *Schlechter 6434* (B, BOL, PRE).

——3128 (Umtata): nr. Umtata, ca. 900 m (-DB), *Flanagan 2858* (BOL, PRE). x2

——3226 (Fort Beaufort): Katberg (-BC), *Sole 408* (BOL, GRA; atypical), *Schonland 4290* (GRA; very atypical); Auckland Forest, Amatole Mtns. (-DB), *Lewis Grant 2777* (BOL, PRE).

——3227 (Stutterheim): Thomas R. (-AB), *Compton 19296* (NBG; atypical); Happy Valley, "Fenfield" (-AC), *Comins 1753* (GRA, PRE; ~~atypical~~); Fort Cunynghame (-AD), *Sim 2853* (NU); Hogsback (-CA), *Rattray s.n.* sub GRA *A20321* (GRA; very atypical); Dohne Hill (-CB), *Sim 1140* (PRE; atypical); Stutterheim commonage, ca. 700 m, *Acocks 9771* (PRE; ± atypical); Pirie, ca. 900 m (-CC), *Sim 19624* (PRE; very atypical); 3 m from Amabele, ca. 800 m (-DA), *Letries* (?spelling) *53* (GRA).

——3228 (Butterworth): Nqamakwe, ca. 900 m (-AB), *Rennie 399* (GRA; ± atypical).

Inexact or doubtful locations: Inungi Mtns. between Cedarville and Mount Frere, ca. 1 700 m, *Story 551* (PRE; atypical); "circa Capetown", *De Castelnan 435* (P; atypical).

8. **G. scabrellum** K. Schum. in Bot. Jahrb. **28:** 113 (1899). Type: Malawi, Nyika Plateau, *Whyte* ("*Carsson*") *269* (B, K!; NU, WU: photos!).
G. bequaertii De Wild. in Rev. Zool. Afr. **9,** Suppl. Bot.: 12 (1921). Type: Zaire, Tshilirunge, *Bequaert 6047* (BR).

Perennial. Stems scrambling, ca. 450 mm long, ± much-branched; ca. 1,5–2 mm in diam., with ± straight, spreading hairs on the 4 distinct angles. Longest internodes 20–25 mm. Middle cauline leaves in whorls of (6–)8(–10), 1-nerved, 10–15 × (1)1,5–2(2,5) mm, linear to narrowly elliptic, with a distinct, whitish acumen at the apex; upper surface smooth or with a few scattered, ± straight hairs, lower surface with hairs at least on the midrib, the usually reflexed margins with closely set reversed prickles. Synflorescences ± cylindrical, paracladia many-flowered, ultimate branches often ebracteate; peduncles 1–2 mm, hairy, pedicels 1–3 mm, hairy or glabrous, divaricate in fruit. Flowers 4-merous; corolla 2–2,5 mm in diam., rotate, often hairy outside, pale yellow; lobes much longer than wide, ± triangular, acuminate; stamina ca. half as long as the lobes, filaments ± filiform, anthers ± elliptic; styles fused to the middle. Fruits dry, glabrous; mericarps ± globose, each ca. 1 mm wide.

Habitat: Shrubby grassland. Ca. 1 050 m.

Flowering Period: November.

Distribution (maps, Figs. 13, 18): Through the mountain systems of Tropical (East) Africa (Uganda, Tanzania, Zaïre, Rwanda, ? Burundi, Malawi, North East Zambia) extending into Rhodesia.

Critical Remarks: Like *G. chloroionanthum* and *G. bussei*, *G. scabrellum* is a species centred in Tropical East Africa which reaches its Southern limit of distribution in the mountains of East Rhodesia. As already discussed, it is closely related to *G. scabrelloides*, but does not seem to have any other close allies amongst the Southern African *Galia*.

COLLECTIONS

RHODESIA—1832: Umtali distr., Odzani River valley (-DA, -DB), *Teague 314* (BOL).

9. **G. subvillosum** Sond. in Fl. Cap. **3:** 38 (1865). Type: South Africa, Cape Prov., Du Toitskloof, 1 000–2 000 ft., *Drège 7687* (S!, W!; NU, WU: photos!)

Perennial with a ± woody rootstock. Stems ± much-branched, prostrate, ascending or scrambling, 150–500(600) mm long, often purplish; (0,7)1–1,5 mm in diam., with 4 ± distinct, sometimes whitish angles, hairy with short, spreading

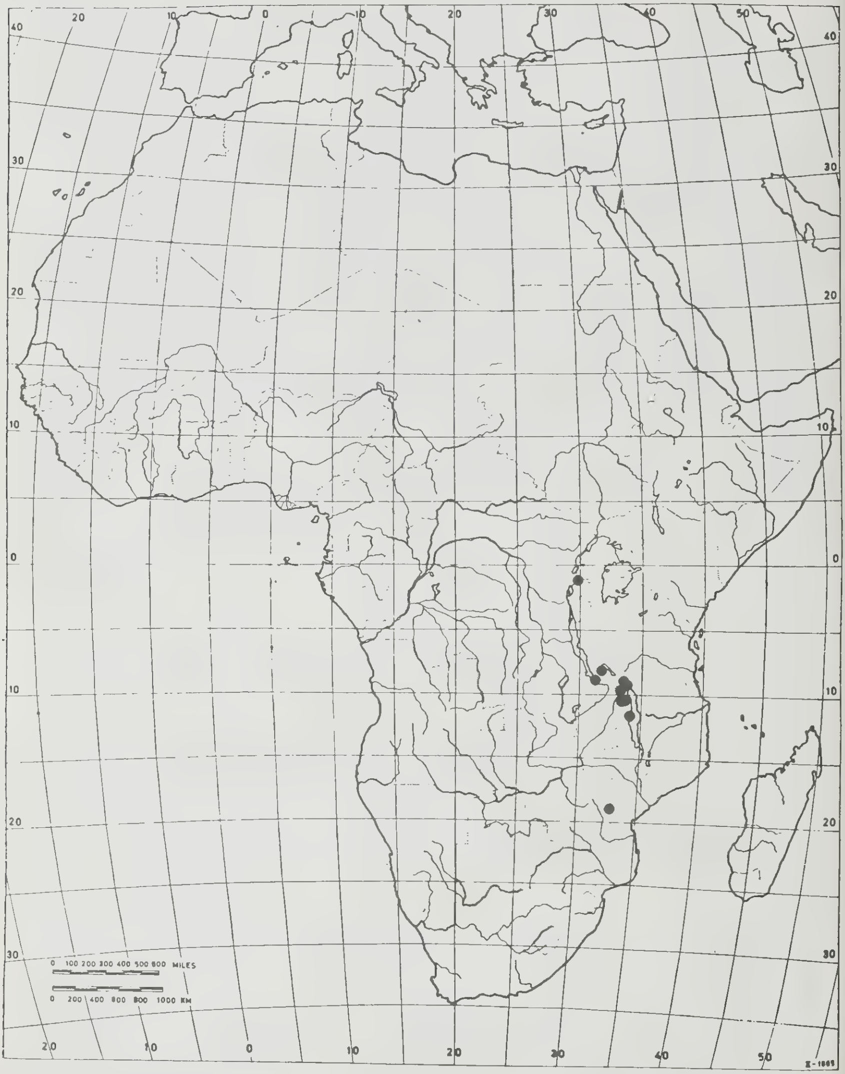

FIG. 18.
Distribution of *G. scabrellum*.

white hairs, glabrous or nearly so. Longest internodes 10–35(40) mm. Middle cauline leaves in whorls of 6, 1-nerved, (5)6–8(11) × (1,5)2–3,5(4,5) mm, oblanceolate or ± lanceolate, with a distinct hyaline point at the apex; with spreading, white hairs on both surfaces and the slightly reflexed margins or glabrous (or nearly so). Synflorescences ± cylindrical, much reduced; paracladia with 3–6 flowers arranged in groups of 3; peduncles (4)5–10 mm, thickish, hairy or glabrous, pedicels with (0)1–2 ± small, lanceolate, hairy or glabrous bracts, (3)4–6(8) mm, slightly enlongating after anthesis, thickish to ± filiform, hairy or glabrous, divaricate in fruit. Flowers strongly protandrous, 4-merous; corolla 3–4 mm in diam., rotate, usually a little hairy outside, whitish-yellow, creamy-yellow or purplish; lobes longer than wide, ± ovate, acute; stamina nearly as long as the corolla lobes, filaments ± filiform, anthers small, elliptic; styles ca. $^2/_3$ fused, less than 1 mm long, free ends arching downward. Fruits dry, wrinkled, with short, straight hairs or glabrous; mericarps subglobose to ± reniform, each 2–2,5(3) mm wide; often only one mericarp developed.

Two varieties recognized:

9a. var. **subvillosum**

Stems and foliage, peduncles and pedicels (densely) covered with short, spreading white hairs. Also corollas (outside) and fruits may be hairy.

Chromosome Number: n = 22, 2n = 44.

Habitat: In grassland, amongst shrubs, at the base of cliffs, on shady river banks; always in fairly moist and cool conditions, never on dry slopes. Ca. (450)600–1 400(1 600) m.

Flowering Period: (August) September to January.

Distribution (map, Fig. 15): Endemic to the mountains of the South West Cape.

9b. var. **subglabrum** Puff, var. nov.

Caules et folia glabra vel pilis albis sparse obtecta, aliter ut in var. *subvilloso*.

Stems and foliage glabrous or nearly so. Also penduncles, pedicels, corolla and fruit are usually hairless.

Type: South Africa, Cape Prov., Bains Kloof, 3 500 ft., *Compton 18632* (NBG).

Chromosome Number: n = 22, 2n = 44.

Habitat and Flowering Period: As in var. *subvillosum.*

Distribution (map, Fig. 15): Endemic to the mountains of the South West Cape.

Critical Remarks: The densely hairy and subglabrous varieties of *G. subvillosum* seem to be worth separating. Both varieties have a similar range of distribution, but var. *subglabrum* appears to be much less common. Although they are sometimes found together [cf. *Puff 760918–2/1* (NU, WU) and *–2/2* (NU, WU), for example], they, according to my field observations, always remain distinct and were never connected by a series of intermediates.

Veld-burning seems to have little effect on the plants. A comparison of individuals from an unburnt and recently burnt area (carried out at the Jonkershoek State Forest near Stellenbosch) revealed only very insignificant differences: plants from the burnt area showed a somewhat increased vegetative growth, slightly longer internodes and wider leaves, but are inseparable otherwise.

The sometimes purplish colour of stems, flowers, and even leaves appears to come about as a result of overexposure to sunlight. Purplish organs were never observed on plants of ± shady locations.

COLLECTIONS

var. *subvillosum*

CAPE—3318 (Cape Town): Groot Drakenstein Mtns., S slopes of Banhoek Spitzkop, 1 220 m (-DD), *Esterhuysen 11866* (BOL); Swartboskloof, *Van Rensburg 2107* (PRE); Jonkershoek State Forest, 600–900 m, *Esterhuysen 9709* (BOL, K, PRE), *Puff 760918–2/1* (NU, WU), *Taylor 4612* (PRE), *Rodin 3231* (BOL).
——3319 (Worcester): Ceres (-AD), *Pearson 3522* (B, BOL, K), *Acocks 1879* (S); Slanghoek Mtns., Observation Peak, SE slopes (-CA), *Esterhuysen 1703* (BOL); —, Cossacks, ca. 1 400 m, *Esterhuysen 24008* (BOL); —, Slanghoek, Needle, cliffs on S side, ca. 1 400 m, *Esterhuysen 17796* (BOL, NBG); Du Toitskloof, ca. 300–600 m, *Drège 7687* (S, W), *Puff 760908–6/2* (NU, WU); Witteberg, ca. 1 600 m, *Esterhuysen 15676* (BOL, K, PRE, SAM), *Esterhuysen s.n.* (WU); Bainskloof, ca. 900–1 050 m, *Schlechter 9184* (BOL, E, GRA, K, P, PRE, S, W), *Esterhuysen 25614* (BOL); Franschhoek Forest Reserve (-CC), *Leighton s.n.* sub BOL *31402* (BOL); —, Berg River Hoek, ca. 900 m, *Compton 13817* (NBG); —, near Bushmen's Castle, *Salter 5736* (BOL); Wemmershoek Mtns., Tierkloof, ca. 1 200–1 500 m, *Esterhuysen 17685* (BOL, PRE); Wemmershoek Peak, ledges on W side, ca. 1 200–1 500 m, *Esterhuysen 11331* (BOL, K, NBG); Drakenstein Mtns., Duivel's Kloof, ca. 900 m, *Esterhuysen 1306* (BOL).
——3320 (Montagu): Lemoenshoek Peak, below summit, ca. 1 600 m (-DD), *Esterhuysen 29491* (BOL; ± atypical).
——3418 (Simonstown): Sir Lowry's Pass (-BB), *Stokoe s.n.* sub SAM *59534* (SAM, PRE); SE of Kogelberg, *Stokoe s.n.* sub SAM *59530* (BOL, SAM; atypical); Pringle E Peak, ca. 600 m (-BD), *Esterhuysen 24660* (BOL; ± atypical).
——3419 (Caledon): Dwarsberg (-AA), *Stokoe 8646* (BOL, K).

COLLECTIONS

var. *subglabrum*

CAPE—3318 (Cape Town): Jonkershoek State Forest, head of Jonkershoek valley (-DD), *Puff 760918–2/2* (NU, WU).
——3319 (Worcester): Bains Kloof, ca. 1 050 m (-CA), *Compton 18632* (NBG),

Puff 760908–5/11 (NU, WU); Slanghoek Mtns., Witteberg, ca. 1 700 m, *Esterhuysen 27611* (BOL);—, Slanghoek Pile, ca. 900 m, *Esterhuysen 1721* (BOL); mountains S of Wemmershoek, S side of summit, 1 450 m (-CC), *Andree 794* (PRE); Franschhoek Forest Reserve, Berg River Hoek, *Esterhuysen 12397* (BOL, PRE), *Compton 13858* (NBG).

——3418 (Simonstown): Sir Lowry's Pass (-BB), *Puff 760920–2/4* (NU, WU); Somerset Sneeuwkop, ca. 1 200 m, *Esterhuysen 8273* (BOL, K); Hottentots-Holland Mtns., above Lourens Ford, *Esterhuysen 3512* (BOL).

——3419 (Caledon): Viljoenspass (-AA), *Puff 760920–3/1* (NU, WU); SW slopes of Victoria peak, ca. 1 050–1 400 m, *Esterhuysen 9765* (BOL).

10. **G. mucroniferum** Sond. in Fl. Cap. **3:** 37 (1865). Types: South Africa, Cape Prov., Du Toitskloof, 1 000–2 000 ft., *Drège 7677* (E!, K!, WU: photo!); —,—, near Genadenthal, 2 000–3 000 ft., *Drège 7686* (E!, K!, P!, PRE!, S!; NU, WU: photos!); no localities given: *Drège 7684*, *7689* (S!); in "Caffraria", *Ecklon & Zeyher s.n.* (S!).

G. dregeanum Sond. in Fl. Cap. **3:** 38 (1865). Type: South Africa, Cape Prov., Du Toitskloof, *Drège 7688* (E!, K!, P!, S!; NU, WU: photos!).

Perennial with a ± woody rootstock. Stems with usually many short lateral branches, scrambling, ascending or erect, 100–550 mm long; 1–2(2,5) mm in diam., glabrous, with few reversed prickles or with white, straight spreading hairs on the 4 distinct, often whitish angles. Longest internodes (15)20–45(55) mm. Middle cauline leaves in whorls of 6(–8), 1-nerved, (8)10–14 × (1)1,3–2(2,5) mm, linear-lanceolate to lanceolate, with a long hyaline point at the apex; glabrous or with a few reversed prickles on the slightly reflexed margins, or with white straight, spreading hairs on upper surface, midrib below and margins; often very shiny. Synflorescences often narrowly cylindrical, much reduced; paracladia with 2–4 flowers arranged in groups of 2; peduncles 5–12(15) mm, filiform or ± thickish, glabrous or hairy, pedicels with (3)2–1(0) minute, ± linear, glabrous bracts, (4)6–10(13) mm, elongating after anthesis, ± filiform, glabrous or hairy, strongly divaricate in fruit. Flowers strongly protandrous, 4-merous; corolla (2,5)3–4 mm in diam., rotate, sometimes with a few hairs outside, greenish-yellow, creamy-yellow or pale green; lobes much longer than wide, acute; stamina nearly as long as the corolla lobes, filaments ± filiform, anthers small, elliptic; styles ca. $^2/_3$ fused, less than 1 mm long. Fruits glabrous, ± granulate or wrinkled, or with short straight hairs; mericarps ± globose, each (2)2,5–3 mm wide; often only one mericarp developed.

Two varieties recognized:

10a. var. **mucroniferum**

Stems and foliage glabrous or with a few reversed prickles on the angles and margins (but never with white, spreading hairs); peduncles and pedicels never hairy; fruits occasionally with a few hairs.

Chromosome Number: n = 22, 2n = 44.

Habitat: In grassland, rocky slopes and ravines; seems to prefer ± cool, sheltered and ± shady locations. Ca. (200)300–900(1 500) m.

Flowering Period: (May to July), September to December.

Distribution (map, Fig. 19): Endemic to the mountains of the South West Cape.

10b. var. **dregeanum** (Sond.) Puff, stat. nov.

G. dregeanum Sond. in Fl. Cap. **3:** 38 (1865). Type: South Africa, Cape Prov., Du Toitskloof, *Drège 7688* (E!, K!, P!, S!; NU, WU: photos!).

Stems (mainly angles), leaves (margins, upper surface, and midrib on lower surface), peduncles, pedicels and fruits covered with white, straight, spreading hairs.

Habitat and Flowering Period: As in var. *mucroniferum.*

Distribution (map, Fig. 19): Endemic to the mountains of the South West Cape.

Critical Remarks: Varietal status seems most appropriate for *dregeanum*, which differs from *G. mucroniferum* only in its hairiness. The separation character 'more robust' listed by Sonder (1865) only holds for the type specimen (the only specimen known to Sonder), but is by no means consistent.

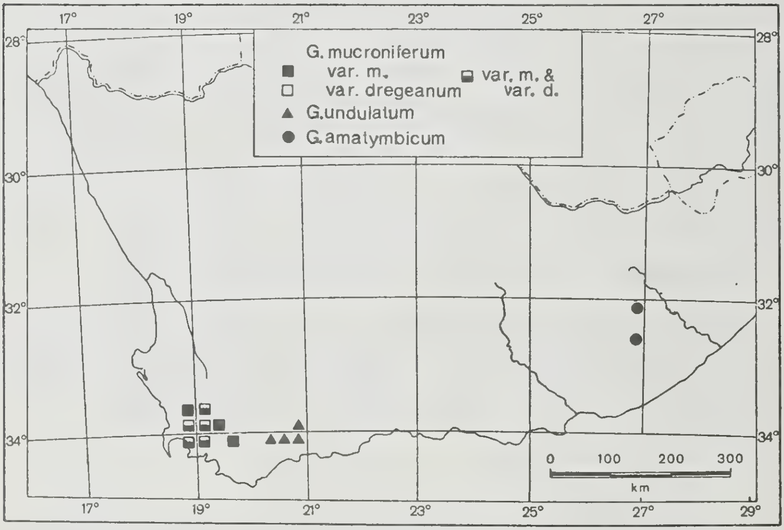

FIG. 19.
Distribution of *G. mucroniferum* var. *mucroniferum* and var. *dregeanum, G. undulatum*, and *G. amatymbicum.*

Var. *dregeanum* seems to be much rarer than var. *mucroniferum*.

G. mucroniferum and *G. subvillosum* constitute a very closely related species pair sharing, among others, the following characters: tetraploidy, very pronounced protandry (cf. Fig. 11), flowers with stamina nearly as long as the corolla lobes (long, thin filaments), and reduced snyflorescences consisting of few groups of 3 flowers (*G. subvillosum*, Fig. 7c) or 2 flowers (*G. mucroniferum*, Fig. 7d) on the paracladia. All these characters distinguish this group from the remaining Southern African *Galium* species. The two species, however, are, in addition to synflorescence differences, easily kept apart by their leaves (short, wide: *G. subvillosum* vs. long, narrow: *G. mucroniferum*). They may virtually grow side by side in the field [cf. *Puff 760908–6/2* (NU, WU) and *–6/3* (WU)], but, according to my field observations, do not hybridize.

COLLECTIONS

var. *mucroniferum*

CAPE—3318 (Cape Town): Paarl Berg (-BD), no collector given (K); Simonsberge (-DD), *Esterhuysen 8812* (BOL); Jonkershoek State Forest, *Parker 4473* (BOL, K, NBG), *Kerfoot 5863* (PRE); —, Biesievlei, ca. 300 m, *Rycroft 865* (NBG); —, Abdol's Kloof, ca. 360 m, *Levyns 7354* (BOL), *Taylor 4570* (PRE), *Adamson 3042* (BOL); —, Idasvallei, ca. 180 m, *Levyns 1418* (BOL).
——3319 (Worcester): Slanghoek Mtns., Witteberg, ca. 1 500 m (-CA), *Esterhuysen 9465* (BOL); Du Toitskloof (-CA, -CC), *Drège 7677* (E, K), *Drège s.n.* (K), *Stokoe s.n.* sub SAM *70002* (SAM), *Barker 5980* (NBG), *Puff 760908–6/3* (WU); —, above Mountain Club Hut (-CA), *Esterhuysen 16548* (BOL, PRE), *Taylor 5416* (PRE); Franschhoek pass, ca. 460 m (-CC), *Marsh 658* (SRGH, K), *Compton 18564* (NBG); —, ca. 900 m, *Schlechter 9252* (BOL, E, K, P, PRE, S); Wemmershoek Peak, *Esterhuysen 11343* (BOL, K); Stettynsberg Mtns. (-CD), *Stokoe s.n.* sub SAM *64217* (SAM).
——3418 (Simonstown): W side of Sir Lowry's Pass, just below top (-BB), *Acocks 5226* (S); near Hottentots-Hollandskloof, *Ecklon & Zeyher 2327* (SAM; not P, S).
——3419 (Caledon): Houhoek Mtns., Nieuwkloof (-AA), *Burchell 8035* (K); Genadenthal, ca. 600–900 m (-BA), *Drège 7686* (E, K, P, PRE, S).

Uncertain location: "In Caffraria", *Ecklon & Zeyher s.n.* (S).

COLLECTIONS

var. *dregeanum*

CAPE—3318 (Cape Town): Stellenbosch (DD), *Duthie 577* (BOL); —, Papegaaisberg, *Worsdell s.n.* (K).
——3319 (Worcester): Du Toitskloof (-CA, -CC), *Drège 7688* (E, K, P, S).

Highly doubtful location: "Port Natal", *Gueinzius s.n.* (W).

11. **G. undulatum** Puff, nom. nov.

G. uncinatum Lichtenst. in Bartl. & Wendl., Beitr. z. Bot. **2:** 12 (1825), nom. illeg. Type: South Africa, Cape Prov. (''Cap. b. Spei''), *Lichtenstein s.n.* (GOET!).

G. glabrum sensu Sond. in Fl. Cap. **3:** 38 (1865), non Thunb.

Perennial with a slightly woody rootstock. Stems ascending to erect, ca. 0,3–1,5 m long, usually with few lateral branches; 1,5–2,5 mm in diam., glabrous or with a few reversed prickles on the 4 distinct angles, often ± glaucous. Longest internodes 30–55(70) mm. Middle cauline leaves in whorls of 6, 1-nerved, (15)20–30 × (6)8–10(11) mm, obovate to obovate-oblong, with a short hyaline point at the apex, cuneate at the base; margins with ± coarse reversed prickles, leaves otherwise glabrous; often glaucous. Synflorescences ± cylindrical, paracladia 3- to ± many-flowered, ultimate branches usually ebracteate; peduncles (5)10–22 mm, glabrous, pedicels (3)5–10(20) mm, slightly elongating after anthesis, filiform, glabrous, divaricate in fruit. Flowers 4-merous; corolla (2,5)3–4 mm in diam., rotate, whitish; lobes much longer than wide, acute; stamina very short, much less than half as long as the lobes, filaments thickish; styles short. Fruits dry, glabrous, granulate; mericarps ± globose, each (2)2,5–3,5 mm wide.

Habitat: Among shrubs on river banks, forest margins and mountain slopes. Always in moist to wet, ± shady locations. Ca. (300)450–1 050(1 200) m.

Flowering Period: September to December (January, February).

Distribution (map, Fig. 19): Endemic to the mountains around Swellendam, Barrydale and Heidelberg.

Critical Remarks: *G. undulatum* has until now been known as ''*G. glabrum* Thunb.''. After an examination of the type specimen [*Thunberg 3315* (UPS)], however, it became evident that ''*G. glabrum*'' must be considered a synonym of *G. tomentosum* (see *G. tomentosum*, ''Critical Remarks'').

The name *G. uncinatum* Lichtenst., considered a synonym of ''*G. glabrum*'' by Sonder (1865), unfortunately is illegitimate: it is a later homonym (4 years) of the validly published name *G. uncinatum* S. F. Gray (1821). The name *G. undulatum* was chosen as nomen novum because this name had already been associated (although erroneously) with *G. uncinatum* Lichtenst. by Steudel (1840), who lists (p. 658) ''*G. undulatum* Lichtenst. in Bartl. Wendl. sec. Ecklon'' as a synonym of ''*G. glabrum* Thunb.''. Ecklon's reference to *G. undulatum* Lichtenst. must have been in error for *G. uncinatum*, the only *Galium* described by Lichtenstein.

G. undulatum is undoubtedly very closely allied to *G. tomentosum* with which it shares the following characters: (usually) very wide, oblanceolate or obovate leaves with reversed prickles on the margins (otherwise glabrous), flowers with very short stamina, and large fruits. Of the two, *G. tomentosum* (dioecious, ''sex-dimorphism'') clearly is the more derived species.

COLLECTIONS

CAPE—3320 (Montagu): Lemoenshoek Peak, slopes above Boesmansbos Forest, ca. 1 050–1 200 m (-DD), *Esterhuysen 10464* (BOL, K); Grootvadersbosch Forest Reserve, Boesmansbos, ca. 1 050 m, *Taylor 3223* (PRE).
——3420 (Bredasdorp): Swellendam (-AB), *Cohen s.n.* sub NBG *23401* (NBG), *Kuntze 30* (K); Swellendam Mtn., *Esterhuysen 4809* (BOL); Duiwelsbosch near Swellendam, *Cruse 29* (S); Duiwelsbosch and Voormansbosch near Puspas Valley (-AB?), *Ecklon & Zeyher 2325* (PRE, S, SAM); on both sides of the Buffeljagdrivier, ca. 300–600 m (-BA), *Zeyher 2725* (K, P, S, SAM, W); Goede Hoop Farm, mountain slopes, ca. 600 m (-BB), *Thorne s.n.* sub SAM *44517* (SAM).

12. **G. tomentosum** Thunb., Fl. Cap. **1:** 551 (1813). Type: South Africa, Cape Prov. ("CBS"), *Thunberg* in herb. Thunberg sub no. *3373 & 3374* (UPS!; NU, WU: photos!).
G. asperum Thunb., Prod. Pl. Cap.: 30 (1794), nom. illeg. Type: South Africa, Cape Prov. ("CBS"), *Thunberg* in herb. Thunberg sub no. *3302* (UPS!; NU, WU: photos!).
G. glabrum Thunb., Fl. Cap. **1:** 551 (1813). Type: South Africa, Cape Prov. ("CBS"), *Thunberg* in herb. Thunberg sub no. *3313* (UPS!; K, NU, WU: photos!).
G. asperum var. *villosum* Eckl. & Zeyh., Enum. Pl. Afr. Austr.: 369 (1836). Type: South Africa, Cape Prov., Clanwilliam distr., near Brakfontein, *Ecklon & Zeyher 2323 β* (GOET!, P!, S!; WU: photo!).
G. namaquense Schlechter, nom. nud.
Rubia lanata Dinter, nom. nud.

Dioecious perennial with a woody rootstock. Stems climbing or scrambling, ca. 0,3(0,5)–2,5(3,0) m long, with many lateral branches; up to 15(20) mm in diam. and terete at the base, (1)1,5–3(4) mm in diam. and distinctly 4-angled in the mid-stem region; with reversed prickles on the angles or (rarely) subglabrous, the upper parts of the stems frequently densely villous; greyish at the base, often purplish in the upper parts. Longest internodes (20)30–80(100) mm. Middle cauline leaves in whorls of 6–8, 1-nerved, (12)15–25(30) × (2)3–8(10) mm, narrowly to broadly obovate, broadly ovate, or ± lanceolate, often acuminate or acute at the apex and cuneate at the base; with densely set reversed prickles on the often slightly reflexed margins and midrib beneath. Synflorescences extensive, ± broadly pyramidal, paracladia many-flowered, of rather different appearance in ♂ and ♀ plants. ♂: peduncles (1)2–3 mm, ± thickish, subglabrous to villous, pedicels 1–2 mm, ± filiform, hairy, strongly divaricate; ♀: peduncles (10)15–30(35) mm, somewhat elongating after pollination, villous; pedicels (20)25–60(90) mm after pollination, ± thickish, convergent. Flowers 4-merous; ♂: corolla (2)2,5–3,5(4) mm in diam., rotate, greenish, greenish-yellow to pale yellow, occasionally somewhat hairy outside; lobes much longer than wide, ± ovate, acute; stamina very short, filaments thickish, shorter than the ovate anthers, gynoeceum rudimentary, disk small. ♀: corolla 3–4 mm in diam., otherwise as in ♂; styles ca. 1 mm, ca. $^2/_3$ fused, disk larger than in ♂; rudimentary stamina usually recognizable. Fruits dry, granulate, glabrous or sometimes with a few whitish hairs; mericarps ± reniform, with 3 distinct furrows along the back, each (1)1,5–2 mm wide and (2)2,5–3 mm long.

Chromosome Number: n = 22, 2n = 44.

Habitat: In semistabilized and stabilized coastal dunes, usually amongst bushes. Inland generally scrambling in ± dense scrub of dry, sun-exposed slopes or river banks, or in dried out river beds; seems to prefer (semi-)arid areas with an annual rain fall of usually not more than ca. 400 mm. Sea level—600 (900) m.

Flowering Period: (August) September to November (December).

Distribution (map, Fig. 20): From the Southern Namib [''desert and succulent steppe'': Giess (1971)] through Namaqualand to the South West Cape; in the Little, Great and Upper Karroo, and eastwards to the Eastern Cape Province.

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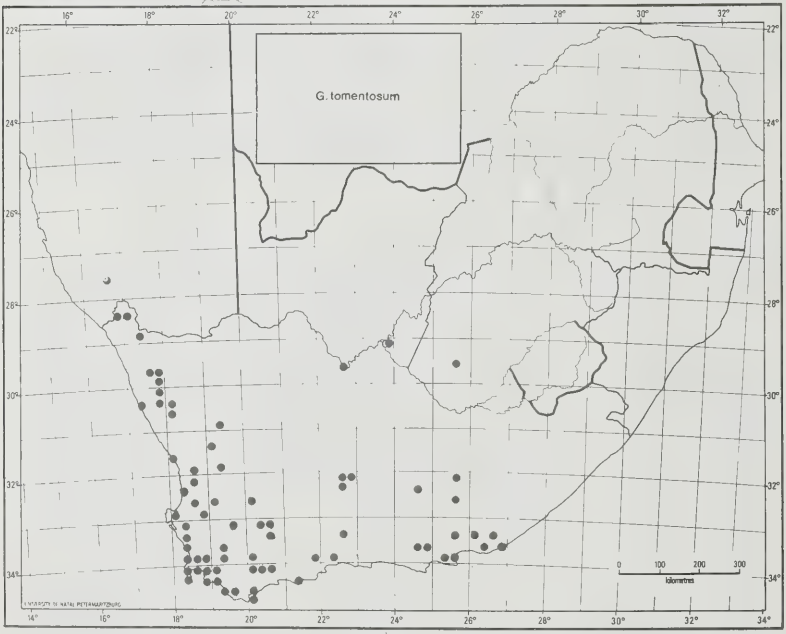

FIG. 20.
Distribution of *G. tomentosum*.

Critical Remarks: *G. tomentosum* and *G. asperum* Thunb. [an illegitimate name: there is an earlier homonym by Schreber (1771)] had long been considered separate species (Ecklon & Zeyher, 1836; Sonder, 1865; Marloth, 1932), since the early authors did not realize that the "two" species are in fact only ♂ (*G. asperum*[1]) and ♀ (*G. tomentosum*) plants of a single species (probably because ♂ and ♀ plants look quite different: dioecism coupled with sex-dimorphism, see below). Salter (1937) finally clarified the situation.

G. glabrum Thunb., described on the same page as *G. tomentosum*, should be included as a synonym of the latter: it merely represents a somewhat atypical (subglabrous), but clearly male plant of *G. tomentosum*.

Dioecism has evolved in a number of *Galium* species, but *G. tomentosum* is the only Southern African species to show this phenomenon. It is also one of the very few in which dioecism is coupled with sex-dimorphism (*G. cotinoides* de Cham. & v. Schlechtend., a Chilian species not related to *G. tomentosum*, for example, is another: Ehrendorfer, personal communication). Although the synflorescences of ♂ and ♀ plants have an identical basic structure (cf. Fig. 7a), their appearance is rather different: in ♀ plants the densely villous peduncles and pedicels are much elongated and ± weak so that in nature they are always pendulous (Fig. 21a, b). In ♂ plants, peduncles and the much less hairy or subglabrous pedicels are short, stiff and straight, and, as a result, the synflorescences are not pendulous. At present, no explanation of the function or possible advantage of dioecism and the long, pendulous ♀ synflorescences in *G. tomentosum* can be offered, but they are certainly not an adaption to anemogamy: *G. tomentosum* is clearly entomogamous, and both, ♂ and ♀ flowers produce much nectar and were frequently found to be visited by small insects particularly in Namaqualand.

No exact data are available about the ratio of ♂ and ♀ plants in a population, but according to my field observations there often seemed to be a slight excess of males, which were normally very easy to spot since they apparently always begin flowering earlier than females. Both predominance of males and their earlier flowering are a common and well documented phenomenon in populations of dioecious flowering plants (cf. Godley, 1964, 1976; Lloyd, 1973).

The woody stems of *G. tomentosum* are very conspicuous and can easily reach a diameter of ca. 15 mm near the base. The wood structure, according to Noel (unpublished personal communication), is somewhat derived: the wood consists of short vessel elements, narrow vascular tracheids and parenchyma. There are however *no* true libriform fibres or vascular rays. There may well be a correlation between the wood structure, unusual for the Rubiaceae, and the ecology of the species: herbaceous, non-woody genera of various non-rubiaceous families are known to have evolved "(semi-) desert species" with woody stems, whose wood structure is similarily derived (Noel, personal communication).

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[1] *G. asperum* var. *villosum* Eckl. & Zeyher, however, refers to ♀ plants.

Plants of very arid habitats often appear to be deciduous: fruiting plants without leaves were rather common amongst the herbarium material investigated, and even in late spring I could observe in the field that numerous plants had already dropped all their leaves with the exception of a few near the tips of the branches.

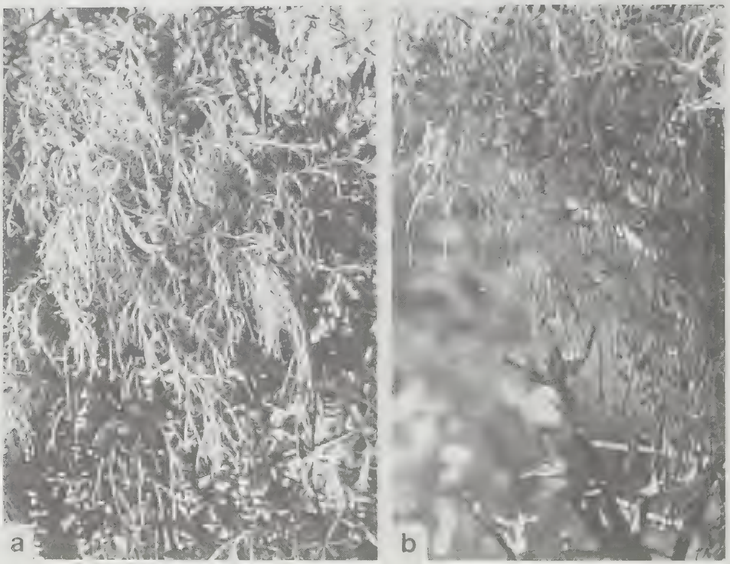

FIG. 21.

G. tomentosum (♀) in its natural habitat (Namaqualand distr., near Kamieskroon, *Puff 768913–1/5*). Explanations in the text.

G. tomentosum is very variable: leaf size and shape in particular may vary considerably (cf. Fig. 5a; note variation within one population), but branching pattern and internode lengths also vary to a certain extent. Variation is also noticeable in the synflorescence region: in ♀ plants there is a continuous series from forms with very many-flowered synflorescences (typical) to forms with rather few flowers on the lateral synflorescence branches (atypical; ± rare); in ♂ plants the extent of the synflorescences hardly varies. The synflorescence in females is always villous, but not so in males: some forms are villous, others only hairy near the tips of the synflorescence branches, and some (rather infrequently) are almost glabrous (such forms have occasionally been confused with *G. undulatum*). None of these variable characters are, however, correlated so that it does not seem appropriate to subdivide the species further.

COLLECTIONS

SOUTH WEST AFRICA—2716 (Witpütz): 10 m S of Witpütz (-DA), *Merxmüller & Giess 2375* (PRE, WIND); Numiesberg, *Dinter 8106* (B, BOL, K, PRE, WIND).

ORANGE FREE STATE—2925 (Jagersfontein): Brakfontein (-DA), *Zeyher 50* (S).

CAPE—2816 (Oranjemund): Koeboes-Grootderm rd., ca. 7-10 m from Koeboes (-BD), *Puff 760911–1/1* (WU).

——2817 (Vioolsdrif): Koeboes (Kuboos) (-AC), *Pillans 5402* (BOL); Stinkfontein (-CD), *Pearson 5527* (B).

——2917 (Springbok): Springbok-Kleinsee rd., ca. 1 m from turn-off to Komaggas, nr. Buffelsrivier (-DA), *Puff 760912–1/1* (NU, WU); Spektakelbergpas, ca. 8 m from Springbok, *Puff 760912–6/4* (NU, WU); nr. Spektakel, ca. 250 m, *Bolus 9420* (BOL); hills at Okiep (-DB), *Pillans 4971* (BOL); between Nababiep and Modderfontein, ca. 900 m, *Bolus 9419* (BOL); hills on W side of Springbok, ca. 980 m, *Acocks 16488* (PRE); ca. 5 m from Springbok on Pofadder rd., *Puff 760910–2/1* (NU, WU); Hester Malan Flower Reserve nr. Springbok, *Puff 760910–1/1* (NU, WU); Droedap (-DD), *Esterhuysen s.n.* sub PRE *41998* (PRE).

——2918 (Gamoep): Brak R., ca. 500 m (-A, -C), *Pearson 3899* (B, BOL).

——2922 (Prieska): around Prieska (-DA), *Bryant 227* (K, PRE).

——2923 (Douglas): St. Clair, banks of Vaal R. (-BB), *Orpen 5967* (BOL); St. Clair-Douglas, *Orpen 163* (SAM).

——3017 (Hondeklipbaai): margin of dry Spoeg R. bed (-AD), *Pillans 18034* (BOL); Ara Koop, ca. 700 m (-BB), *Schlechter 11236* (B, E, GRA, K, S, W); Kamieskroon, *Thorne s.n.* sub SAM *48889* (SAM), sub NBG *23394* (NBG); nr. Kamieskroon, on rd. to Leliefontein, *Puff 760913–1/5* (NU, WU); Bowesdorp, *Stokoe 8214* (BOL, PRE, SAM); S of Brakdam (-BD), *Pearson 5627* (B, BOL, K).

——3018 (Kamiesberg): 3 m E of Kamieskroon, W slopes of Kamiesberg, ca. 1 100 m (-AC), *Acocks 14988* (PRE); nr. Garies, foothills of Kamiesbergen (-CA), *Esterhuysen 1409* (NBG, PRE); Wolfhok-Garies rd., ca. 5 m from Garies, *Puff 760913–2/12* (NU, WU).

——3019 (Loeriesfontein): Loeriesfontein Ravine, ca. 800 m (-CD), *Pearson 4843* (BOL, K).

——3118 (Vanrhynsdorp): Ebenezar, on the Olifants R., below 300 m (-CA), *Drège 7671* (K, W); Nardouw (-DC), *Maguire 1048* (BOL, NBG).

——3119 (Calvinia): Bokkeveld, Nieuwoudtville, 700 m (-AC), *Marloth 7802* (PRE); Botterkloof pass (-CD), *Hall 3879* (NBG).

——3218 (Clanwilliam): Verlorevlei (-AD), *Compton 15064* (NBG); Graafwater (-BA), *Zinn 64219* (SAM); nr. Piketberg (-DA, -DD), *Bolus 14284* (NH), *Gulline 2617* (NBG); nr. Brakfontein, *Ecklon & Zeyher 2323β* (GOET, P, S, WU), *Drège "76.1"* (GOET).

——3219 (Wuppertal): between Citrusdal and The Baths (-CA), *Puff 760913–1/1* (NU, WU).

——3220 (Sutherland): Houthoek (-CA), *Hanekom 745* (PRE).

——3222 (Beaufort West): Nieuwefeld (-BA), *Drège s.n.* (S); between Beaufort and Renosterkop, ca. 760–910 m (-BB, -BC), *Drège s.n.* (K); Sunnyside (Beaufort West distr.), *Esterhuysen 2729* (PRE).

——3224 (Graaff-Reinet): nr. Graaf-Reinet, ca. 760 m (-BC), *Bolus 144* (BOL, K), *145* (BOL).

——3225 (Somerset East): Baroda, 15 m N of Cradock, ca. 950 m (-BA), *Dyer 1044a* (GRA, PRE); Somerset East (-DA), *Bowker s.n.* (K); Somerset East distr. (?): between Zuurbergen and Klein-Bruitjeshoogte, *Drège s.n.* (''*tomentosum a*'', E, K, P, S, W).

——3318 (Cape Town): In fields nr. Hopefield (-AB), *Letty 134* (PRE); Darling, ca. 75 m (-AD), *Gulline 2104* (NBG); nr. Darling, ca. 110 m, *Bolus 12702* (BOL, NH, PRE), *Puff 760915–1/1* (NU, WU); Groot Post, *Salter 6471* (BOL); Contreberg, *Bachmann 1100* (K, P); around Mamre (''Groenekloof'') (-CB), *Zeyher s.n.* sub SAM *10675, 37551* (SAM); Mamre Hill, *Compton 9829* (NBG); Blaauwberg (Blouberg), *Stokoe 67538* (SAM); Blaauwbergstrand (-CD), *Maguire 1279* (NBG); Milnerton (-CD, -DC), *Andrae 389, 392* (PRE); Harmonie (-DC), *Michell 238* (BOL, PRE); mountainous places at Klapmuts, ca. 150–460 m (-DD), *Ecklon & Zeyher s.n.* sub PRE *20106* (PRE; as *''Drège 92.10''* in GOET, WU).

——3319 (Worcester): nr. Karroo Poort, Swartruggens Mtns. (-BA), *Stokoe 7537* (SAM); ''Veld Reserve'' nr. Worcester (-CB), *Olivier 152* (PRE), *Van Breda 36* (PRE); Hex River nr. De Doorn, ca. 500 m (-CD), *Bolus 11899* (PRE); entrance to Hex R. valley, *Davidson 45* (SAM).

——3320 (Montagu): Snyders Kloof (-AB), *Foley 139* (PRE); Matjiesfontein, ca. 900 m (-BA), *Compton 2715* (BOL); —, (''Maggiesfontein''), *Rehmann 2939* (K); environment of Matjiesfontein, Witteberg at Whitehil, *Humbert 9750* (P); foot of Witteberg (-A, -B), *Compton 2528* (BOL); Witteberg Kloof, *Adamson s.n.* (BOL); Ngaap Kop, ca. 1 070 m, *Compton 12620* (NBG); Dobbelaars Kloof, ca. 700 m (-BC), *Levyns 6663* (BOL; atypical); Montagu baths (-CC), *Page s.n.* sub PRE *42011* (PRE); Baden Kloof, ca. 500 m (-CC?), *Compton 18364* (NBG), *Lewis s.n.* sub SAM *59532* (SAM), *Levyns 7941* (BOL); Kochmannskloof (Kogmans Kloof) (-CC), *Zeyher s.n.* (SAM).

——3321 (Ladismith): Bergkloof, ca. 7 m from Herbertsdale (-DD), *Puff 760922–1/1* (NU,WU).

——3322 (Oudtshoorn): De Rust, Farm ''Doornkraal'', 400 m (-BC), *Dahlstrand 1575* (GRA), *2183* (PRE), *2454* (PRE); George (-CD), *Ecklon & Zeyher ''94.12''* (S.).

——3323 (Willowmore): Willowmore distr., Wolvefontein, *Anderson s.n.* sub SAM *3755* (SAM).

——3324 (Steytlerville): Kouga R. Poort, ca. 300 m (-DA), *Fourcade 3083* (BOL, K); on the Zwartkoprivier (-DB), *Zeyher 225* (K, S, SAM), *2720* (S).
——3325 (Port Elizabeth): Dunbrodie, Sundays R. valley, ca. 60–120 m (-BC), *Rennie 406* (BOL; atypical); Uitenhage (-CD), *Ecklon & Zeyher "2–1"* (S); Redhouse (-DC), *Paterson 96* (GRA), *96a* (GRA, BOL); Uitenhage-Coega rd., ca. 1,3 m from Coega, *Puff 760924*–1/1 (NU, WU).
——3326 (Grahamstown): Alicedale (-AC), *Cruden 66* (GRA); Cradock rd., 6–7 m outside Grahamstown (-BC), *Stauffer 5191* (K, P, PRE), *5192* (P, PRE); Alexandria-Pt. Alfred rd., ca. 5 m from Alexandria (-CB), *Puff 760924–2/1* (WU); Pt. Alfred (-DB), *Marloth 10201* (PRE); Albany distr., Albany, *Bowker s.n.* (K).
——3418 (Simonstown): Rondevlei (-AB), *Compton 24362* (NBG); nr. Muizenberg, 6 m, *Schlechter 1487* (B); Fish Hoek Bay, ca. 15 m, *Bolus 4834* (BOL); Kommetjie, *Brain s.n.* (SRGH); Witsand Bay, *Salter 6386 A, B, C* (BOL, K, S); Southeast Point, *Wolley Dod 2991* (K); Cape of Good Hope Nature Reserve, nr. Cape of Good Hope (-AD), *Puff 760917–1/1* (WU); Swartklip (-BA), *Puff 760919–2/14* (NU, WU), *Esterhuysen 26456* (BOL); nr. Zeekoe Vlei (-BA, -BB), *Wolley Dod 872* (BOL); Faure (-BB), *Parker 4509* (BOL, K, NBG); Hottentots-Holland Mtns., *Zeyher s.n.* (S), *Liuvenberg* (?spelling) *s.n.* (S), no collector given (K); surroundings of Somerset West, in Hottentotsholland, *Ecklon & Zeyher "83"* (S); E of Cape Hangklip (-BD), *Rourke 704* (NBG, S).
——3419 (Caledon): Bosjesveld (-AA), *Van Zijl s.n.* (SAM); Friekkie se Baai (-AC), *Leighton 1556* (BOL), E of Betty's Bay, *Puff 760920–1/1* (NU, WU); between Elim and Gansbaai (-CB, -DA), *Stokoe s.n.* sub SAM *64218* (SAM).
——3420 (Bredasdorp): ca. 1,5 m outside Stormsvlei on Stormsvlei-Bonnievale rd. (-AA), *Puff 760921–1/1* (NU, WU); Swellendam (-AB), *Ecklon & Zeyher "98–9"* (S); nr. Swellendam, *Zeyher s.n.* sub SAM *16075* (SAM); nr. Bontebok (-AB, -BA), *Wall s.n.* (S); Struis Bay (-CA, -CC), *Esterhuysen 4433* (BOL), *Hafström & Acocks 2242* (PRE, S).
——3421 (Riversdale): Stilbaai (-AD), *Muir 120* (GRA), *5101* (BOL, PRE).

Uncertain or doubtful localities: Little Namaqualand, Waterkloof at Doornpoort, *Pillans 5370* (BOL); "Stellenbosch, Worcester, Swellendam and Uitenhage", *Ecklon & Zeyher 2323* (GOET, P, S, SAM, W); "Karroo", *Ecklon & Zeyher 2324* (GOET, P, S, SAM, W); "Vumansberg" (?spelling), *Julinek s.n.* (W); "Regio orientalis" or "CBS", *Sparrman s.n.* (S), *Thunberg s.n.* (S, 4 sheets), *Wolley Dod 3680* (BOL), *Drège s.n.* (K), *Zeyher s.n.* (K), *Zeyher* herb. no. *347* (P), *Dahl s.n.* (S), *Bauer 94* (W), *Scholl s.n.* (W).

13. **G. chloroionanthum** K. Schum. in Bot. Jahrb. **30:** 417 (1901). Type: Tanzania, Rungwe Mtn., *Goetze 1162* (B, BM, K!; NU, WU: photos!).

Perennial. Stems climbing or creeping, up to 2,3 m long, with few lateral branches; 1,5–2 mm in diam. (mid-stem), with ± large, hyaline reversed prickles on the 4 distinct, whitish angles, and often densely hairy at the nodes. Longest

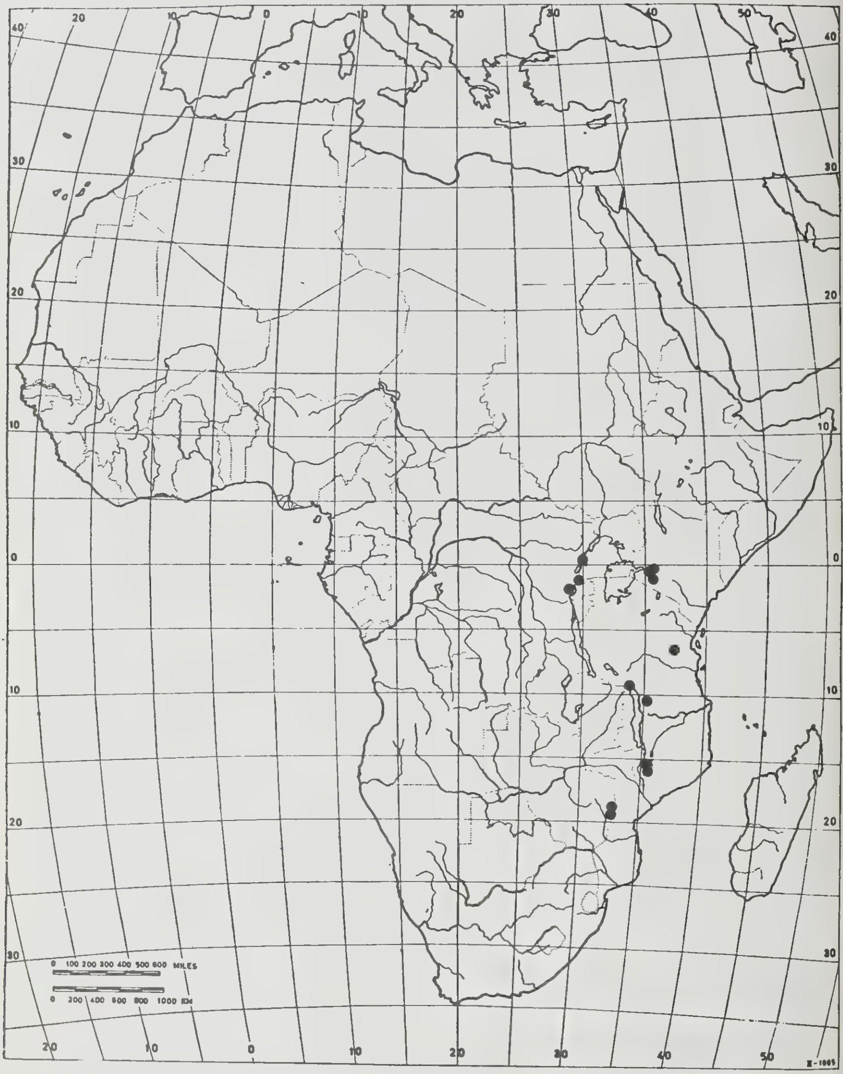

FIG. 22.
Distribution of *G. chloroionanthum*.

internodes 55–100 mm. Middle cauline leaves in whorls of 6, 1-nerved, (22)25–35(40) × (5)7–12(15) mm, (broadly) elliptic to obovate, abruptly acuminate at the apex, cuneate at the base; upper surface glabrous or with a few short, straight hairs, margins and midrib (beneath) with coarse, ± hyaline reversed prickles. Synflorescences extremely reduced; paracladia 1-flowered, peduncles 0,4–0,8 mm before, 10–20 mm after anthesis, pedicels 0,5–1 mm, with 1(2) ± large to minute bract(s), glabrous. Flowers 4-merous; corolla ca. 3–4 mm in diam., rotate, with a few hairs outside, greenish-white to greenish-yellow; lobes about as long as wide, ± acute; stamina short. Fruits dry, densely covered with brownish, flattened (?), hooked hairs; mericarps ± reniform, each 1–1,5 mm wide.

Habitat: In forests. Ca. 1 800–2 000 m.

Flowering Period: December to February.

Distribution (maps, Figs. 17, 22): In tropical East Africa from South Sudan (according to Ehrendorfer & Verdcourt, 1973, and Verdcourt, 1976; no specimens seen by me and, therefore, not shown in map, Fig. 22), Uganda, East Zaïre, Rwanda, Burundi, Kenya to Tanzania, and southward to South Malawi and Rhodesia.

Critical Remarks: The closest allies of the ± tropical *G. chloroionanthum*, which just reaches its southern limit of distribution in the mountains of East Rhodesia, seem to be *G. brenanii* Ehrend. & Verdc., *G. ruwenzoriense* (Cortesi) Chiov., and *G. aparinoides* Forssk., all of which are centred in Uganda, Kenya and Tanzania (Ehrendorfer & Verdcourt, 1973). It does not seem to have close affinities to any Southern African species.

COLLECTIONS

RHODESIA—1832: Inyanga distr., Rhodes Inyanga National Park, Pungwe Gorge, ca. 1 800 m (-BD), *Chase 5664* (LISC, PRE, SRGH).

——1932: Umtali distr., Himalaya Mtn., Banti North, ca. 2 000 m (-BD), *Wild 4517* (LISC, K, SRGH).

14. **G. spurium** L. ssp. **africanum** Verdc. in Kew Bull. **30:** 324 (1975). Type: Kenya, Kiambu distr., Muguga, *Milne-Redhead & Taylor 7147* (K!; NU, WU: photos!).

G. horridum sensu Eckl. & Zeyh.: Enum. Pl. Afr. Austr.: 370 (1836), non Thunb.

G. aparine sensu Sond. in Fl. Cap. **3:** 38 (1865), non L.

Annual. Stems weak, prostrate to semi-erect, (0,12)0,3–ca.2 m long, with ± few lateral branches; (0,8)1,5–2,5 mm in diam., with reversed prickles on the 4 distinct angles. Longest internodes (20)35–75 mm. Middle cauline leaves in whorls of 6–8, 1-nerved, (8)15–38(45) × (1,5)3–6(7) mm, linear-lanceolate to obovate, with a distinct, ± filiform acumen at the apex, cuneate at the base; upper surface glabrous or with a few scattered ± straight or curled hairs, midrib (beneath) and margins with coarse reversed prickles. Synflorescences extremely reduced; paracladia 1(2)-flowered, peduncles/pedicels (8)12–20(35) mm when in fruit, ± arcuate, with reversed prickles or (seldom) glabrous; pedicels occasionally separated from peduncle by a small, ± linear bract (in that case paracladia often 2-flowered). Flowers 4-merous; corolla (1)1,2–1,8(2) mm in diam., rotate, glabrous, greenish, greenish-white or creamy-white; lobes longer than wide, ± ovate to triangular, pointed; stamina very short, filaments ± thickish, anthers roundish; styles short. Fruits dry, with non-tuberculate, white hooked hairs less than 0,5 mm hairs long; mericarps ± globose, each (1,8)2,5–4 mm wide.

Chromosome Number: n = 20, 2n = 40.

Habitat: Amongst shrubs along river banks, in forest margin vegetation, scrub forests, rocky mountain slopes, or (seldom) in dune forest margins; occasionally in cultivated ground, disturbed areas and margins of plantations. Seems to prefer sheltered, damp and ± shady locations. Ca. 20–1950 m.

Flowering Period: All year round.

Distribution (maps, Figs. 23, 24): From Ethiopia (Cufodontis, 1965, as *G. aparinoides* Forssk.), Somali Republic, Socotra (not shown in map, Fig. 23), East and West Sudan, Zaïre, Cameroun: Cameroun Mtn., Uganda, Kenya, Rwanda, Burundi, Tanzania and Malawi to South Africa. (Pre – T (Natal Cape) According to Verdcourt (1976) also in Rhodesia (no specimens seen by me and, therefore, not shown in map, fig. 23).

Critical Remarks: The identity of the plant long identified as *G. aparine* L. in Southern (and Eastern) Africa and often thought to be an introduction from Europe (Sonder, 1865; Adamson & Salter, 1950) is now firmly established: it must be included in *G. spurium* L. as proposed by Verdcourt (1975), and is best treated as a subspecies of its own. One of the main reasons for this conclusion is the plant's chromosome number: *G. spurium* L. has a chromosome base number of x = 10 (ssp. *spurium* is diploid and has n = 10, ssp. *africanum* is tetraploid and has n = 20), whereas *G. aparine* L. has a base number of x = 11 (cf. Puff, 1977).

While plants from the Transvaal and Natal always agree perfectly well with the description and type of *G. spurium* ssp. *africanum*, the situation seems somewhat more problematical in the Cape Province: in addition to "typical" collections, there are a number of specimens that differ in having somewhat more extensive synflorescences (± long paracladia with three to four, and even six flowers). Such forms bear a close morphological resemblance to both *G. spurium* ssp. *spurium* and *G. aparine*. One is tempted to conclude that they are introductions which, in the Cape Province, occur together with the indigenous *G. spurium* ssp. *africanum*. No chromosome counts of these critical (and rare) plants are available, and, unfortunately, pollen measurements (Fig. 3d) do not contribute much to the solution of the problem either: average pollen diameters are somewhat smaller than those of *G. spurium* ssp. *africanum*, but yet there is a certain amount

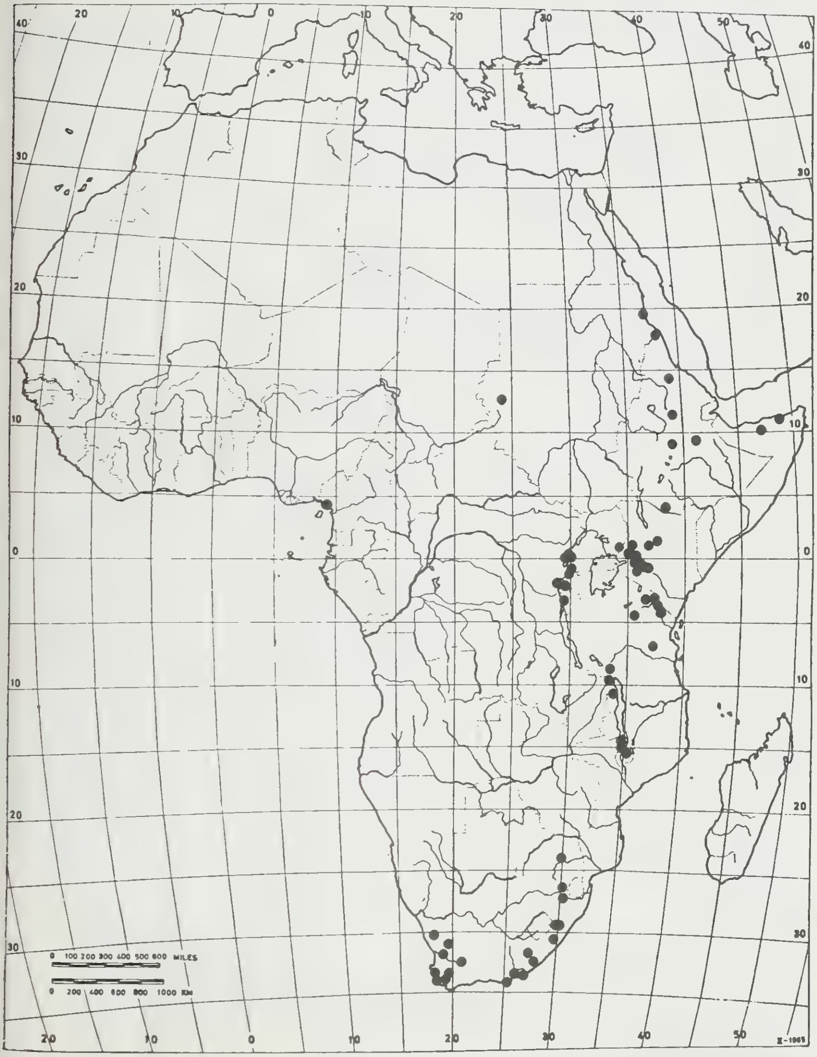

FIG. 23.
Distribution of *G. spurium* ssp. *africanum*.

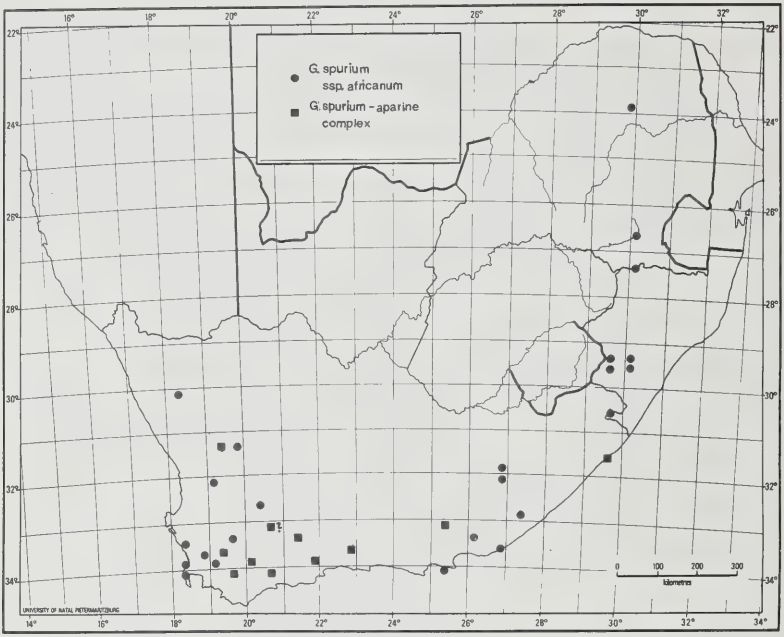
● G. spurium ssp. africanum
■ G. spurium - aparine complex
16°
18°
20°
22°
24°
26°
28°
30°
32°
34°
14°
22°
24°
26°
28°
30°
32°
34°
0
100
200
300
kilometres
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FIG. 24.
Distribution of *G. spurium* ssp. *africanum* in Southern Africa; distribution of plants belonging to the "*G. spurium-aparine* complex" (explanations in the text).

of overlap. Pollen grain size would fit into the range given for the diploid *G. spurium* ssp. *spurium* (cf. Moore, 1975), but on the other hand, the collections in my opinion more closely resemble *G. aparine*, which, however, is polyploid.

A detailed study (which must include karyological investigations), is therefore needed to solve the problem. These critical collections at present can only provisionally be identified as "*G. spurium-aparine* complex".

COLLECTIONS

TRANSVAAL—2329 (Pietersburg): Houtbosh (-DD), *Rehmann 6031* (K).
——2630 (Carolina): Maviristad (-CA), *Pott 4886* (BOL), *15152* (PRE).
——2730 (Vryheid): Farm "Oshoek" nr. Wakkerstroom, ca. 1 900 m (-AC), *Devenish 807* (PRE), *Puff 770102–3/1* (NU, WU).

NATAL—2929 (Underberg): Kamberg Nature Reserve, Gladstone's Nose ridge, ca. 1 830 m (-BC), *Wright 837* (NU), *Puff 760418–1/6* (NU, WU); Farm "Game Pass", Gladstone's Nose Ridge, adjacent to Kamberg Nature Reserve, ca.

1 980 m, *Puff 760418–1/1* (NU, WU), *–1/3* (NU, WU); Bulwer-Impendhle rd., on Ngelotsontwana stream (-DA), *Hilliard & Burtt 7610* (E, K, NU); Polela, ca. 1 200–1 500 m, *Medley Wood 4585* (K, NH).

——2930 (Pietermaritzburg): Curry's Post (-AC), *Pickworth s.n.* (NU); Lion River-Dargle rd., roadside nr. Dargle (-CA), *Puff 761125–1/1* (WU).

——3029 (Kokstad): Zuurberg nr. Weza, ca. 1 300 m (-DA), *Schlechter 6604* (B, BOL, PRE).

CAPE—3018 (Kamiesberg): Leliefontein, ca. 1 550 m (-AB), *Levyns 4066* (BOL).

——3119 (Calvinia): nr. Calvinia, on rd. to Clanwilliam, ca. 900 m (-BD), *Levyns 5070* (BOL); Calvinia distr., Ekerdam, *Taylor 2689* (NBG).

——3126 (Queenstown): Queenstown, ca. 1 900 m (-DD), *Galpin 1800* (GRA).

——3219 (Wuppertal): Agtertuin, ca. 240 m (-AA), *Schlechter 10862* (E, GRA, K, P, PRE, S, W).

——3220 (Sutherland): Klipbanksrivier, Roggeveld foothills, ca. 900 m (-CB), *Acocks 16950* (PRE).

——3226 (Fort Beaufort): jct. Queenstown valley and Zwartkei, ca. 1 200–1 350 m (-BB), *Galpin 8125* (PRE).

——3227 (Stutterheim): King William's Town, ca. 600 m (-CD), *Sim 19606* (PRE, WU).

——3228 (Butterworth): Idutywa distr., *Pegler 734* (PRE).

——3318 (Cape Town): summit of Contreberg (-AD), *Pillans 6908* (BOL); Kirstenbosch, Nursery Gorge, Table Mtn. (-CD), *Esterhuysen 352* (BOL); Paarlberg (-DB), *Drège 7670* (E, K, P, PRE).

——3319 (Worcester): Hex River Mtns., E slopes of Prospect Peak, ca. 900 m (-BC), *Esterhuysen 15937* (BOL, PRE); Klein Drakenstein Mtns., Kasteelkloof Catchment, ca. 680 m, *Kruger 1450* (PRE).

——3326 (Grahamstown): Alicedale (-AC), *Cruden 67* (GRA); Port Alfred (Kowie East) (-DB), *Britten 764* (GRA, PRE), *Dyson s.n.*, Nov. 1915 (PRE), June 1916, *Dyson 89* (GRA).

——3418 (Simonstown): Orange Kloof (-AB), *Salter 7822* (BOL); Hout Bay Golf Course, *Acocks 676* (PRE); Simon's Bay, *Wright s.n.* (K).

——3424 (Skoenmanskop): nr. Sea View, margin of dune forest, ca. 60 m, *Acocks 21429* (PRE).

Inexact locality: Namaqualand distr., between Kamieskroon and Leliefontein, ca. 820 m, *Salter 1500* (BOL, K, PRE).

COLLECTIONS

"*Galium spurium-aparine* complex"

CAPE—3119 (Calvinia): Soetwater, 21 m W of Calvinia (-AD), *Maguire 1927* (NBG).

——3129 (Port St Johns): Port St Johns, ca. 5 m (-DA), *Schonland 4064* (PRE).
——3319 (Worcester): Worcester, Karoo Garden (-CB), *Barker 5916* (NBG);—, Veld reserve, *Van Breda 55* (PRE), *Olivier 152(a)* (PRE).
——3320 (Montague): Klein Roggeveld, 1 100 m (-BA?), *Marloth 9600* (PRE); Bonnievale, ca. 500 m (-CC), *Levyns 4585* (BOL).
——3321 (Ladismith): Seven Weeks Poort, ca. 550 m (-AD), *Levyns 2507* (BOL); Hassaquaskloof (= ? Attaquaskloof) (-DD), *Zeyher 2722* (S, SAM).
——3322 (Oudtshoorn): Wilge R., WSW of Uniondale, ca. 600 m (-DB), *Acocks 20619* (PRE).
——3325 (Port Elizabeth): Hoeksplaas, ca. 1 850 m (-AB), *Acocks 23532* (PRE).
——3419 (Caledon): on the banks of the Zonder-Einde (Riviersonderend) (-BA), *Zeyher 2723* (SAM).
——3420 (Bredasdorp): Farm Napky, ca. 120–150 m (-BA), *Taylor 3777* (PRE), *Acocks 22593* (K, PRE).

Uncertain or inexact localities: on the banks of the Olifants R. and at Brakfontein, *Ecklon & Zeyher s.n.* sub PRE *21018* (PRE), *Drège "76.9"* (E); mtns. nr. Brakfontein, *Ecklon & Zeyher 2329* (SAM); on the banks of the Kenkorivier (?spelling), *Zeyher 2724* (K, S, SAM); between Stormsvlei and Bonnievale, *Acocks 1746* (S).

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Taxa to be Excluded

Galium horridum Thunb., Fl. Cap. **1:** 556 (1813).
= *Rubia horrida* (Thunb.) Puff in Kew Bull. **32:** 432 (1978).

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